

College of Agriculture and Natural Resources

151 Agriculture Building

Frank Galey, Dean

Phone: (307)766-4133 Fax: (307)766-4030

Web site: www.uwyo.edu/uwag

The College of Agriculture and Natural Resources offers a wide variety of course work in agriculture, natural resources, molecular biology, and family and consumer sciences. The curriculum provides a sound background in basic sciences and the choice of a number of fields in which to specialize. Students are trained in principles which apply throughout the world, with special emphasis on agriculture and natural resources found in the Rocky Mountain region.

Laboratory work is stressed in all programs because of its importance in agricultural and natural resource professions. Students receive excellent training from case studies and practical experience provided at research and extension centers. Other facilities include modern laboratories and classrooms, an abattoir, meat processing rooms, farm shop, greenhouses, and wool laboratory.

In addition to the academic departments, the college includes the Agricultural Experiment Station and the Cooperative Extension Service. Materials and techniques resulting from this effective triple combination benefit both students and staff in the never-ending search for problem-solving information. The close relationship between teachers, researchers, and extension workers creates a learning atmosphere that encourages the development of the finest students.

Programs of Study Undergraduate Degrees

Bachelor of Science

- Agricultural business
- Agricultural communications
- Agroecology
- Animal and veterinary sciences
- Microbiology
- Molecular biology
- Rangeland ecology and watershed management

Bachelor of Science in Family and Consumer Sciences

Bachelor of Applied Science

- Organizational leadership

Graduate Degrees

Master of Arts

- Molecular biology

Master of Science

- Agricultural and applied economics
- Agricultural economics/water resources
- Agronomy
- Animal and veterinary sciences
- Entomology
- Entomology/water resources
- Family and consumer sciences
- Family and consumer sciences/Early childhood development
- Food science and human nutrition
- Molecular biology
- Rangeland ecology and watershed management
- Rangeland ecology and watershed management/water resources
- Reproductive biology
- Soil science
- Soil science/water resources

Doctor of Philosophy

- Agronomy
- Animal and veterinary science
- Entomology
- Molecular and cellular life sciences
- Molecular biology
- Rangeland ecology and watershed management
- Reproductive biology
- Soil science

The following certificates and/or degrees in the College of Agriculture and Natural Resources are available through the UW Outreach School:

- Certificate: Early Childhood Program
- Director
- Bachelor of Applied Science
- Online bachelor's degrees: Family and Consumer Sciences (Professional Child Development or Family and Community Services Options)

For more information, contact the UW Outreach School at (800) 448-7801 or go to the web at outreach.uwyo.edu.

The College of Agriculture and Natural Resources also offers a graduate certificate in reclamation and restoration ecology. For more information, contact the Department of Ecosystem Science and Management.

Basic Education Core

All undergraduates in College of Agriculture and Natural Resources curriculums are required to follow the basic education core as noted below.

Core Components (USP 2015)	Hrs.
First-Year Seminar (FYS).....	3
Quantitative Reasoning (Q).....	3
Communication 1 (COM1).....	3
Communication 2 (COM2).....	3
Communication 3 (COM3).....	3
Human Culture (H).....	6
Physical & Natural World (PN).....	6
U.S. and Wyoming Constitutions (V).....	3
Subtotal (min. core requirements).....	30
Hours for major, support areas and electives as determined by division...	90-98
Total Hours	120-128

Core Components (USP 2003)	Hrs.
Intellectual Community (I).....	1-3
Writing 1 (WA).....	3
Oral Communication (O).....	3
Quantitative Reasoning 1 (QA)*.....	3
Quantitative Reasoning 2 (QB).....	3
Science (S, SB, SP, SE).....	4-8
Cultural Context (C, CH, CS, CA).....	9
U.S. and Wyoming Constitutions (V).....	3
Physical Activity and Health (P).....	1
Subtotal (min. core requirements).....	30-36
Hours for major, support areas and electives as determined by division....	79-91
Total Hours	120-128

*Core Components are mutually exclusive of each other; hence, two core components may not be fulfilled by the same course. Except for the QA, core courses may have topics from the embeddable components list included in their curriculum, where appropriate.

Courses taken for S/U

A maximum of 20 elective hours with a grade of S (satisfactory) may be included as part of the total credit requirements for graduation; but no S/U hours may be used to satisfy university, major requirements or required electives, unless the course is offered for S/U grading only.

Minors in Agriculture and Natural Resources

Minors provide a formalized recognition of concentrated study in a specific subject area. A minor degree offers recognition for academic achievement outside of the students' major course curriculum and gives students a concentration of work in the chosen minor area.

A minors program can enable students to enhance and expand career opportunities. A minor will also improve the possibility of admission to graduate programs in any chosen major, minor, or related field of study.

Minors Available in the College of Agriculture and Natural Resources Include:

- Agricultural business
- Agroecology
- Animal and veterinary science
- Apparel design
- Farm and ranch management
- Forest resources
- General agricultural economics
- Horticulture
- Human development and family sciences
- Human nutrition
- Insect biology
- Interior design
- International agricultural economics
- Molecular biology
- Natural resource economics
- Plant protection
- Rangeland ecology and watershed management
- Reclamation and restoration ecology
- Soil science

Agricultural Communications Major

A wide variety of courses in agriculture, communications, and journalism provides students with basic preparation for positions as broadcasters, editors or writers for farm and home organizations, state and federal agencies, magazines, newspapers, radio and television stations, and commercial businesses. Communication skills are also distinct assets in agricultural sales, research, service and teaching.

Students enrolled in agricultural courses acquire up-to-date and knowledgeable backgrounds of the subject matter. Courses in communication and journalism develop proficiencies demanded by employers of communication professionals.

Minimum Requirements for Agricultural Communications Majors (B.S.)

	Hrs.
University Studies Program requirements.....	30
Communications/journalism core	24
COJO 1000, 1040, 2010, 2100, 3530 and minimum of 9 hours of communication/journalism elective	
Agriculture core requirements	42
At least 18 hours must be lower division (Ag 1000-2000) elective courses, and at least 24 hours must be upper division (Ag 3000-4000) elective courses and include AGRI 4975.	
Supporting course requirement	4
STAT 2050 or 2070	
Additional hours for major and electives	20
Total Hrs:	120

Students wishing to pursue an area of emphasis in the agricultural communications option are encouraged to also select a minor. The college currently offers 19 minors, and any of these can help to better prepare students for employment or graduate work. (see above)

Agricultural communication majors also may complete an internship in their field. A variety of opportunities are available and students can work with the Associate Dean to determine an appropriate internship for their area of emphasis.

Agriculture (AGRI)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1001. Intellectual Community and Information Literacy in Agriculture. 2. [I,L♦(none)] For students interested in Environmental, Human and Life Sciences, Agriculture and Natural Resources, or for anyone with interests in Ecology and Behavior. Comprised of a series of guest presentations, supplemented by class discussions, case studies, field trips, and demonstrations, reflective writings, and small group, active cooperative learning activities.

1520. Field Practices: Extension. 1-2 (Max. 2). Project based work that includes practice applications of Extension programming. Directed by Extension faculty around matching topics of youth development, rangeland resources, food safety and nutrition, community development, or profitable and sustainable agriculture. Local issues are addressed in the context of applied research for public good.

2100. International Experiences in Natural Resources. 1-3 (Max. 3). Cultural and environmental topics in another country through classroom sessions, self study, and a visit to the host country. Topics discussed include similarities and differences in natural resource and environmental issues, history, traditions, and cultural norms, focusing on the host country and the United States.

3000. Discovering and Utilizing Ideas and Information. 3. [I,L♦(none)] Learning in this area guides students to accessing, evaluating, and utilizing information and ideas; communicating information and ideas effectively and responsibly; civic engagement for individual, organizational and community problem-solving, and applying new skills, knowledge, and perspectives in a contemporary society. Prerequisites: WA and junior status.

4350. Problem Solving in Organizational Settings. 3. Students apply organizational leadership perspectives and methods to the resolution of a variety of simulations and real world problems. The course will emphasize leadership development as a tool for individual, organizational and community problem solving. Prerequisites: junior or senior standing and COM2.

4500. International Experiences in Agriculture. 1 (Max. 3). Learn about agricultural customs in another country through classroom lectures, written assignments, and a visit to the host country during the spring break period. Topics discussed include the influence of foreign agriculture on U.S. economies and agricultural practices, focusing on the host country. Prerequisites: completion of WA course and junior standing.

4520. Field Practicum: Extension Work. 1-4 (Max. 8). Provides practical experiences to those wanting to pursue a career with Cooperative Extension Service. Interns are matched with county-based personnel for hands-on learning experiences across the state. Develop working knowledge of CES's mission to provide the citizens of Wyoming with education and applied research. Dual listed with AGRI 5520. Prerequisite: must pass volunteer screening process.

4546. Agriculture: Rooted in Diversity. 3. [C,D♦(none)] Addresses multiple themes related to diversity in agriculture with the goal of making visible the experiences of minorities and women in agriculture. Involves significant independent research, class discussion, project development, and development of oral and written communication skills. Establishes linkages with supporting disciplines. Cross listed with ENGL/AIST/CHST/FCSC/AMST/HIST 4546. Prerequisites: Junior class stand-

ing or consent of instructor and concurrent enrollment or major in any of the following: ethnic studies, agriculture, American studies, anthropology, English, history, sociology, or women's studies.

4600. Developing Organizational Leadership. 3. [(none)♦COM3] A senior capstone experience for Bachelor of Applied Science students, bringing together reading, research, writing, and communication skills to focus on a major project. Leadership skills and approaches to organizational problem-solving are deepened using the structural, human resource, political, and symbolic frames to change and improve leadership and organizational culture. *Prerequisites:* COM1, COM2, AGRI 3000, and senior status.

4700. Elements of Leadership. 3. Focuses on a basic understanding of theory and practice. Will develop self-awareness and provide a foundation for continued development of leadership skill in the workplace, the community and the home. *Prerequisite:* Restricted enrollment. Prior approval required.

4960. Bachelor of Applied Science Internship. 6. Provides Bachelor of Applied Science students academic credit for advanced work experiences in their area of specialization. Required to complete academic assignments such as a weekly journal, discussion and writing assignments in addition to their field-based responsibilities. Takes place in a mentored, supervised setting. *Prerequisites:* Bachelor of Applied Science student, AGRI 3000, senior status, and consent of instructor.

4975. Agricultural Communications Senior Project. 1. A baccalaureate degree capstone experience incorporating self assessments of student learning, reflective writings, and an analysis, synthesis and evaluation of the agricultural communications curriculum. Students develop and present a personalized, comprehensive, professional portfolio. *Prerequisite:* agricultural communication major with senior standing and WB.

4990. Topics. 1-6 (Max. 8). Accommodates topics whose subject matter is not included in other College of Agriculture and Natural Resources and Natural Resources offerings. Please see the class schedule for current topic. *Prerequisite:* WB.

5520. Field Practicum: Extension Work. 1-4 (Max 9). Organization, teaching, and promotion of county programs.

5900. Practicum in College Teaching. 1-3 (Max 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate status.

5920. Continuing Registration: On Campus. 1-2 (Max 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1 - 3. (Max 99). Designed to provide an enrichment experience in a variety of topics. Note: Credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1 - 12. (Max 16). Graduate level course 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.

Department of Agricultural and Applied Economics

206 Agriculture Building, (307) 766-2386
FAX: (307) 766-5544

Web site: www.uwyo.edu/agecon

E-mail: ag-econ@uwyo.edu

Department Head: Roger Coupal

Professors:

NICOLE S. BALLENGER, B.A. University of California, Santa Cruz 1975; M.S. University of California, Davis 1980; Ph.D. 1984; Professor of Agricultural Economics 2004.

ROGER COUPAL, B.S. Utah State University 1978; M.S. University of Arizona 1985; Ph.D. Washington State University 1997; Professor of Agricultural Economics 2015, 1997.

DON MCLEOD, B.S. St. John's College 1982; M.S. Oregon State University 1987; Ph.D. 1994; Professor of Agricultural Economics 2015, 1995.

L. STEVEN SMUTKO, B.S. Colorado State University 1978; M.C.R.P. North Dakota State University 1982; Ph.D. Auburn 1995; Spicer Chair of Collaborative Practice, Professor of Agricultural Economics 2009.

DAVID T. TAYLOR, B.S. Montana State University 1972; M.S. 1973; Ph.D. Colorado State University 1987; Professor of Agricultural Economics 1994, 1985.

GLEN D. WHIPPLE, B.A. Brigham Young University 1974; M.S. Utah State University 1976; Ph.D. Washington State University 1980; Professor of Agricultural Economics 1990, 1985; Director, UW Extension.

Associate Professors:

MATTHEW A. ANDERSEN, B.A. Colorado College 1991; M.S. Colorado School of Mines 2000; Ph.D. University of California, Davis 2005; Associate Professor of Agricultural Economics 2013, 2007.

CHRISTOPHER T. BASTIAN, B.S. University of Wyoming 1987; M.S. 1990; Ph.D. Colorado State University 2004; Associate Professor of Agricultural Economics 2010, 2005.

MARIAH D. EHMKE, B.S. Kansas State University 1997; M.S. Ohio State University 2001; Ph.D. Purdue University 2005; Associate Professor of Agricultural Economics 2012, 2005.

DANNELE E. PECK, B.S. University of Wyoming 2000; M.S. 2002; Ph.D. Oregon State University 2006; Associate Professor of Agricultural Economics 2012, 2006.

BENJAMIN S. RASHFORD, B.S. University of Wyoming 1999; M.S. 2001; Ph.D. Oregon State University 2006; Associate Professor of Agricultural Economics 2012, 2006.

CHIAN A. RITTEN, B.S. Northern Arizona University 2003; M.A. Colorado State University 2007; Ph.D. 2011; Associate Professor of Agricultural Economics 2013.

JOHN RITTEN, B.S. Arizona State University 2001; M.B.A. New Mexico State University 2004; Ph.D. Colorado State University 2008; Associate Professor of Agricultural Economics 2015, 2008.

Assistant Professor:

KRISTIANA M. HANSEN, B.A. Reed College 1996; M.S. University of California, Davis 2003; Ph.D. 2008; Assistant Professor of Agricultural Economics 2009.

Academic Professionals:

COLE EHMKE, B.A. Bethany College 1997; M.S. University of Sydney, Australia 1999; Associate University Extension Educator 2011, 2005.

BRIDGER M. FEUZ, B.S. University of Wyoming 1994; M.S. 1996; Senior Extension Educator 2012, 2004.

THOMAS FOULKE, B.A. University of Montana 1985; M.S. University of Wyoming 1992; Senior Research Scientist 2010, 1998.

JOHN HEWLETT, B.S. Montana State University 1985; M.S. Oregon State University 1987; Extension Educator 1987.

BRIAN LEE, B.S. University of Wyoming 2010; M.S. 2012; Research Scientist 2012.

DUANE D. WILLIAMS, B.S. Oklahoma State University 1981; M.S. 1983; Ph.D. Kansas State University 1995; Senior Academic Professional 2014.

Temporary Lecturer:

JIM THOMPSON, B.A. Occidental College; M.A., Ph.D. University of Illinois-Chicago.

Professors Emeritus:

Edward Bradley, Larry J. Held, James J. Jacobs, Dale Menkhous, Carl Olson, Alan C. Schroeder

The Department of Agricultural and Applied Economics offers four options within the agricultural business bachelor of science degree program. They are agribusiness management, farm and ranch management, international agriculture, and livestock business management. All four options focus on the development of critical thinking, research, negotiation, and communication skills for students interested in

1. agricultural operations,
2. small rural businesses,
3. community economics,
4. financial institutions,
5. agricultural and natural resources development and,
6. other pursuits where applied economic tools will be useful.

A brief description of minimum course requirements for each of the four options in agricultural business is given below. In addition, faculty advisers will work with students to tailor a curriculum to individual interests and goals.

Agribusiness Management Option

This curriculum is for students preparing for careers in the agribusiness field. Applied agricultural economics courses are supplemented with marketing, management, finance and other courses from the College of Business and production-oriented courses from other departments in the College of Agriculture and Natural Resources.

Minimum Course Requirements for Agricultural Business (B.S.) Majors within the Agribusiness Management Option¹

	Hrs.
First-Year Seminar (FYS).....	3
Writing	9
ENGL 1010 ² (COM1), Communication II (COM2) ³ , AGEC 4965 or AGEC 4970 (COM3)	
Quantitative (Q) (required for major).....	7
MATH 1400; 2350 ⁴	
Science ⁵ (PN)	6
Human Culture (H) ⁶	6
U.S. & Wyoming Constitutions (V).....	3
Agricultural Economics ⁷	24
1010, 1020, 3400, 4050 or MKT 3210 (count for both upper-division AGEC and business credit), 4060, 4500; either 4450 or 4830 or 4840 or 4880; 3 hours of AGEC electives	
Supporting Agriculture	9
AG College hours other than Agricultural Economics	

Statistics	4
Computers ⁸	3
Supporting Economics	6
ECON 3010 and 3020	
Business	15
ACCT 1010 and 1020; and 9 hours of 3000-4000 level business courses	
Electives	25
Total Hours	120

¹A minimum of 42 credits must be at the 3000 and 4000 level for graduation. At least 30 of the 42 credits must be earned from UW.

²Recommend or equivalent COM1 course.

³Majors in agribusiness management option must satisfy this requirement by earning 3 credits in a USP approved COM2 course other than AGEC 3400. AGEC 3020 is recommended.

⁴MATH 2350 is required as of fall 2008.

⁵Credits earned in USP approved science courses offered within the College of Agriculture and Natural Resources shall also serve as Supporting Agriculture credits.

⁶H requirement cannot be fulfilled with AGEC or ECON courses; USP-approved H language courses are recommended.

⁷24 credit hours in Ag Econ beyond those earned to satisfy University Studies requirements. 18 of these 24 credit hours must be at the 3000-4000 level.

⁸COSC 1200 recommended, or AGRI 1010, or IMGT 2400.

Farm and Ranch Management Option

This curriculum is for students intending to become operators or professional managers of farms, ranches or feedlots. It is also well suited for students interested in the field of agricultural finance, or a minor in biological fields such as agroecology or range management.

In this option, courses in farm and ranch management, finance, and marketing are supplemented by courses in crops, range management, veterinary sciences and animal science, with electives in other areas.

Minimum Course Requirements for Agricultural Business (B.S.) Majors within the Farm and Ranch Management Option¹

	Hrs.
First-Year Seminar (FYS).....	3
Writing	9
ENGL 1010 ² (COM1), Communication II (COM2) ³ , AGEC 4965 or AGEC 4970 (COM3)	
Quantitative (Q) (required for major).....	7
MATH 1400; 2350 ⁴	
Science ⁵ (PN)	6
CHEM 1000 or 1020 or 1050.....	4
SOIL 2010	4

One additional PN course	3
Human Culture (H) ⁶	6
U.S. & Wyoming Constitutions (V).....	3
Agricultural Economics ⁷	28
1010, 1020, 2020, 3400, 4640, 12 hours AGEC electives	
Supporting Agriculture	12
SOIL 2010 and 8 AG College hours other than Agricultural Economics	
Statistics	4
Computers ⁸	3
Supporting Economics	6
ECON 3010 and 3020	
Business	3
ACCT 1010	
Electives	29
Total Hrs.	120

¹A minimum of 42 credits must be at the 3000 and 4000 level for graduation. At least 30 of the 42 credits must be earned from UW.

²Recommend or equivalent COM1 course.

³Major in the Farm and Ranch Management Option must satisfy this requirement by earning 3 credits in a USP approved COM2 course other than AGEC 3400. AGEC 3020 is recommended.

⁴MATH 2350 is required as of fall 2008.

⁵Credits earned in USP approved science courses offered within the College of Agriculture and Natural Resources shall also serve as Supporting Agriculture credits.

⁶H requirement cannot be fulfilled with AGEC or ECON courses; USP-approved H language courses are recommended.

⁷24 credits in Ag Econ beyond those earned to satisfy University Studies requirements. 18 of these 24 credit hours must be at the 3000-4000 level.

⁸COSC 1200 recommended, or AGRI 1010, or IMGT 2400.

International Agriculture Option

This curriculum is for students who desire training related to international agricultural business, or with agricultural and economic problems of developing nations. International trade and relations, world food production, agricultural and economic geography, foreign language, economic development and comparative systems are emphasized in this program.

Minimum Course Requirements for Agricultural Business (B.S.) Majors within the International Agriculture Option¹

	Hrs.
First-Year Seminar (FYS).....	3
Writing	9
ENGL 1010 ² (COM1), Communication II (COM2) ³ , AGEC 4965 or AGEC 4970 (COM3)	

Quantitative (Q) (required for major).....7	
MATH 1400; 2350 ⁴	
Science ⁵ (PN)	6
Human Culture (H) ⁶	6
U.S. & Wyoming Constitutions (V).....3	
Agricultural Economics ⁷	24
1010, 1020, 4060 or 4450, 4600 or 4660, 4880 or ECON 4720, AGECE 3860 or 4280 or 4460, and 6 hours of AGECE electives	
Supporting Agriculture ⁸	6
AG College hours other than Agricultural Economics	
Statistics	4
Computers ⁹	3
Supporting Business.....	12
BUSN/INST 2000, ECON 3010, 3020 and 4740	
Supporting International.....	15
POLS 2310 or 4240 or 4255 or 4330; or GEOG 1020 or 3030 or 3050; or ANTH 1200 or 4260 or 4310 or 4330 or 4340; or INST 4110 or 4300 or 4330; or AGECE 4930 ¹⁰ or BUSN 4540 or MKT/ INST 4540 or other pre-approved courses	
Foreign Language ¹¹	12
1010, 1020, 2030	
Electives	10
Total Hrs.	120

¹A minimum of 42 credits must be at the 3000 and 4000 level for graduation. At least 30 of the 42 credits must be earned from UW.

²Recommended or equivalent COM1 course.

³Major in the International Business Option must satisfy this requirement by earning 3 credits in a USP approved COM2 course other than AGECE 3400. AGECE 3020 is recommended.

⁴MATH 2350 is required as of fall 2008.

⁵Credits earned in USP approved science courses offered within the College of Agriculture and Natural Resources shall also serve as Supporting Agriculture credits.

⁶H requirement cannot be fulfilled with AGECE or ECON courses; USP-approved H language courses are recommended.

⁷24 credits in Ag Econ beyond those earned to satisfy University Studies requirements. 18 of these 24 credit hours must be at the 3000-4000 level.

⁸Recommend AECE 1000, ANSC 1010, FDSC 1410, FCSC 1140, PLNT 2300, ENTO 1000 or 1001, REWM 2000 or 3020.

⁹COSC 1200 recommended, or AGRI 1010, or IMGT 2400.

¹⁰An approved international internship (AGECE 4930) or experience (such as AGECE 4280) is highly recommended for the AGRI Business majors within the International Agricultural option. A maximum of 3 credits of AGECE 4930 can be applied within the International Agriculture option.

¹¹If a student wishes to use their elective hours to contribute to a minor in foreign language (18 hours beyond the 12 hours required, 6 credits of International Social Sciences, Business and Economics requirement can be waived).

Livestock Business Management Option

This curriculum is for students intending to work in any sector of the livestock industry, ranging from input suppliers, to ranches, feedlots, meat packing companies, marketing and sales agents, futures/commodities exchange groups, policy makers, and international trade organizations. In this option, courses in farm and ranch management, agricultural finance, marketing, and trade are supplemented with courses in animal science, biology, range management, food science, data analysis, and other disciplines. Students may pursue a minor in Animal Science as part of this option, but can choose the non-minor version instead. Students will gain a broad understanding of both the business and science of the livestock industry.

Minimum Course Requirements for Agricultural Business (B.S.) Majors within the Livestock Business Management Option (without a minor)

	Hrs.
First-Year Seminar (FYS) ^{1,2}	3
Writing - Communication ^{2,3}	9
COM1 ^{2,3} , COM2 ^{2,3,4} , COM3 - AGECE 4965 or AGECE 4970 ²	
Quantitative (Q)	7
MATH 1400 ² ; 2350 ³	
Science (PN) ⁵	8
CHEM 1000; LIFE 1010	
Human Culture (H) ⁵	6
U.S. & Wyoming Constitutions (V)	3
Agricultural Economics ⁶	31
AGECE 1010, 1020, 2020, 4640, 3400 or 4710, 4060, 4050 or MKT 3210, AGECE 4830 or 4840 ⁷ , 4880 or 4280 or ECON 4720, AGECE 4500	
Additional Quantitative Skills.....	10
STAT 2050 or 2070 ³ ; COSC 1200 or IMGT 2400 ⁸ ; AGECE 4230 or 4840 or STAT 3050 or IMGT 2400 or 3400 or MATH 2355 or ACCT 1010 or 1020	
Biology of Livestock (for Animal Science minor ⁹)	36
LIFE 2022, ANSC 3010, ANSC 4120, ANSC 2010, ANSC 3100, LIFE 3050, ANSC 4540, ANSC 3150 or 4220 or 4230 or 4240, PATB 4110, FDSC 2040 ¹⁰ , FDSC 3060	

Biology of Livestock (for non-minor ¹¹).....7	
LIFE 2022, ANSC 1010, ANSC 4050, REWM 2000, REWM 3020, LIFE 3050, ANSC 4540, ANSC 2020, PATB 4110 or REWM 4000, FDSC 2040, FDSC 3060	

Supporting Business.....	3
ECON 3020	

Electives	4-5
Total Hrs.	120

A minimum of 42 credits must be at the 3000 and 4000 level for graduation. At least 30 of the 42 credits must be earned from UW.

¹Transfer students who earn an A.A., A.S. or A.B. are waived from all USP requirements except COM3, V, and departmental requirements (MATH 1400 & 2350). FYS is waived for transfer students with 30 or more credits earned after high school, or 1 full year completed at another college (but less than 30 credits completed). COM3 automatically fulfills old I, L requirements.

²Must earn a "C" or better.

³Or equivalent course.

⁴Recommend AGECE 3020. A transfer student may fulfill COM2 with a USP approved intermediate composition course and a USP approved public speaking course.

⁵PN and H may not be fulfilled by AGECE or ECON courses.

⁶18 hours of upper-division, not including AGECE 3020, 4965, or 4970. ECON 4720 can be counted towards these 18 hours.

⁷AGECE 4840 may not be double-counted towards both Agricultural Economics and Quantitative Skills.

⁸Suggest COSC 1200 for most, or AGRI 1010 (for inexperienced users), or IMGT 2400 (for advanced users).

⁹Must earn a "C" or better in all courses required in the minor to earn the minor.

¹⁰FDSC 2040 is not actually required for the minor, but is recommended because of its relevance to all sectors of the livestock industry. Advisors may petition a substitution if it fits a student's needs better.

¹¹Courses identified for the non-minor option represent the most relevant livestock-related courses. However, if scheduling conflicts or other needs arise, advisors may petition for substitutions.

Environment and Natural Resources

Students interested in natural resource or environmental issues or careers may complete any of the four options within agricultural business offered by the department with an environment and natural resource emphasis. Inquiries about environment and natural resource concentrations in agricultural business should be directed to the Department of Agricultural and Applied Economics.

Minors Program

The department also offers five minor programs. These five minors are to give students majoring in other undergraduate curricula in the university a concentration of work in any of the specialized undergraduate curricula offered by the department or in general agricultural economics. Each minor requires 27 hours in prescribed course work including 6 hours in supporting agriculture. Students need to plan their course work to meet course prerequisites.

Agricultural Business Minor. AGECE 1010, 1020, 4050 or MKT 3210, and 4060; ACCT 1010; 6 additional hours in upper-level agricultural economics courses; 6 hours in supporting agriculture courses.

Farm and Ranch Management Minor. AGECE 1010, 1020, 2020 and 4640; 9 additional hours in upper-level agricultural economics courses; 6 hours in supporting agriculture courses.

International Agriculture Minor. AGECE 1010, 1020, 3860 and 4880; 6 additional hours in upper-level agricultural economics courses; 3 hours in foreign culture or language; 6 hours in supporting agriculture courses.

Natural Resource Economics Minor. AGECE 1020, 4700, 4720, and 4750; choose 9 additional hours from: AGECE 4450, 4600, 4710, ECON 2400, 4400, 4410, 4520 (note: College of Business prerequisites), ENR 4500.

General Agricultural Economics Minor. AGECE 1010, 1020 and 15 additional hours in agricultural economics courses with 12 hours at the upper-level; 6 hours in supporting agriculture courses.

Graduate Study

The Department of Agricultural and Applied Economics offers graduate work leading to the Master of Science degree. Students may choose among major options in the areas of agricultural and applied economics and agricultural business. The Plan A agricultural economics major emphasizes research with any of the following focus areas:

- production economics and management,
- marketing and market analysis,
- resource and environmental economics,
- international agriculture, and
- economic and rural development.

The Plan B agricultural business option offers advanced skills to students who desire professional careers in the business sector. Students in the agricultural business option may concentrate their coursework and writing

in management, marketing, or finance. Dual majors in water resources, and environment and natural resources are also offered.

Finally, the Department offers a graduate minor in applied economics. This program is for currently enrolled graduate students in other disciplines seeking a foundation in economics as well as their major discipline.

Program Specific Admission Requirements

Undergraduate major in agricultural economics or economics is not required.

Students may be required to complete program prerequisite courses, without graduate credit, that were not completed in their undergraduate education.

Specifically, students who have not completed at least one course in calculus, statistics, and intermediate microeconomic theory may be required to complete these courses without graduate credit during their first semester in residence.

Program Specific Degree Requirements

Master of Science in Agricultural Economics

The following courses constitute the M.S. in Agricultural Economics core requirements and are required of all Plan A candidates (20 hours).

Economic Theory

AGECE 5310 Theory of Producer Behavior...	3
AGECE 5630 Advanced Natural Resource Economics	3
AGECE 5710 Advanced Agricultural Market Theory	3
AGECE 5740 Theory of Consumer Behavior	3

Quantitative Methods

AGECE 5230 Intermediate Econometric Theory	3
AGECE 5320 Quantitative Methods in Agricultural Economics	3

Research

AGECE 5650 Research Methods	1
AGECE 5880 Advanced Seminar	1

Plan A (thesis):

Minimum of 30 credit hours including AGECE M.S. core requirements, thesis hours and electives.

No more than three hours of AGECE coursework numbered below 5000-level count toward the 30 hour requirement.

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

The student's graduate committee, nominated by the major professor, the student, and the department head determine the final program of study and thesis research topic.

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.

Plan B (non-thesis):

Minimum of 32 hours of coursework;

Non-thesis business analysis paper accepted by the student's graduate committee.

Minimum of 13 credit hours of agricultural economics coursework numbered at the 5000-level are required, including:

AGECE 5310
AGECE 5740
AGECE 5880
AGECE 5630 or 5710
AGECE 5320 or 5230

In addition, students are required to complete 3 credit hours from each of the following three areas:

Management:

AGECE 4060, 4640 or 5460; or MGT 4410, 4420, 4440, 4470, or 4520

Marketing:

AGECE 4050, 4830, 4840, 4880, or 5710; or MKT 4240, 4430, 4520, or 4540

Finance:

AGECE 4500; or FIN 4510, 4520, 4610, 4810; or ECON 4740

Remaining credit hours will be filled with electives.

The student's graduate committee, nominated by the major professor, the student and the department head determine the final program of study and business analysis topic.

Presentation of the business analysis paper at a formal public seminar.

An internship experience is strongly encouraged as part of the agricultural business option (AGECE 5990).

Master of Science in Agricultural Economics/ Water Resources; Plan A (thesis):

Students must complete the 20 credit hour agricultural and applied economics M.S. core requirements plus 4 thesis hours and 10 credit hours in water resources approved courses.

Please refer to Water Resources Degree program in this *Catalog* for updated degree requirements.

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

The student's graduate committee, nominated by the major professor, the student and the department head determine the final program of study and business analysis 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.

Master of Science in Agricultural Economics/Environment and Natural Resources (ENR); Plan A (thesis):

Students must complete the 20 credit hour agricultural and applied economics M.S. core requirements plus 4 thesis hours and 15 credit hours in environment and natural resources, as approved by the student's committee and the ENR academic adviser.

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

The student's graduate committee, nominated by the major professor, the student and the department head determine the final program of study and business analysis topic, which must be in the area of environment and natural resources.

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.

Graduate Minor in Applied Economics:

Graduate standing.

AGEC 4640, AGECE 5310 or 5740, AGECE 5320 or 5230, and 6 additional credits of graduate AGECE courses.

Committee selection for the student's major thesis or dissertation committee should include at least one faculty member from AGECE.

Agricultural Economics (AGECE)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦♦Q]).

1000. Agricultural and Applied Economics Orientation. 2. [I,L♦♦(none)] Directs students through a series of short writing and research exercises designed to improve the academic skills of new or prospective agribusiness majors. Also explores cultural diversity, career opportunities and degree requirements

for majors, and strategies for using campus resources. Offered S/U only. (Normally offered fall semester)

1010. Principles of Macroeconomics. 3. [CS♦♦H] A beginning study of how economic society is organized and uses scarce resources to provide for its material wants. National income analysis; business cycles; the banking system; monetary and fiscal policy. Inflation and unemployment. Cross listed with ECON 1010.

1020. Principles of Microeconomics. 3. [CS♦♦H] A basic study of value and price theory, monopoly and public policy; markets for productive goods and services; alternative forms of economic organization; international trade. Cross listed with ECON 1020.

1101. First-Year Seminar. 3. [(none)♦♦FYS]
2020. Farm and Ranch Business Management. 4. Discusses economic principles, business methods and science applied to organization and operation. Includes measurements of size of business; rate and efficiency of production. (Normally offered fall semester)

3000. Small Enterprise Management. 3. Discusses tools for managerial decision-making, including demand analysis, input and output decisions, short- vs. long-term decision-making, linear programming, and risk management. Students will apply this knowledge to small-scale production and value-added agriculture, niche markets, and alternative enterprises. Prerequisites: AGECE 1020 or ECON 1020 and MATH 1400.

3020. Practice Makes Perfect: Applying Principles of Economics to Current Agricultural and Agribusiness Problems. 3. [(none)♦♦COM2] The purpose of the class is twofold: to practice the application of concepts, tools, and models from principles of economics to real-world problems and issues affecting agriculture and agribusiness; and to develop foundational written, oral, and digital communication skills for sharing knowledge and understanding or applied economic analyses. Prerequisites: AGECE/ECON 1020 and AGECE/ECON 1010, or equivalent, and satisfactory completion of COM1 requirements. COSC 1200 recommended.

3400 [4400]. Agricultural Law. 3. [WB♦♦(none)] Surveys legal issues and principles of practical concern to agriculture and examines legal institutions authorized to carry out laws affecting agriculture. Prerequisite: WA/COM1 and junior standing. (Normally offered fall semester)

3750 [4750]. Natural Resource Planning and Economics. 3. Economic concepts and rudimentary analytical tools are applied to federal, state and local natural resource plan-

ning and management programs. The value of economic input into natural resource policy is examined. Evaluating tradeoffs and resolving conflicts play a particularly important role in the course content. Cross listed with ENR 3750. Prerequisites: QA/Q, WA/COM1 and junior standing. (Offered spring semester of odd-numbered years)

3860 [4860]. Economics of World Food and Agriculture. 3. [G♦♦(none)] Explores global food and agricultural issues with a focus on hunger, chronic malnutrition, and diets of people in developing countries. Introduces basic economic concepts pertinent to understanding and analyzing global food markets and prices and to evaluating government policies designed to reduce food insecurity, enhance diets, and promote agricultural development. Cross listed with INST 3860. Prerequisite: An economics principles course. (Normally offered spring semester)

4050. Agribusiness Marketing. 3. Students develop a strategic marketing plan for an agricultural and food product. Content includes study of aspects of the global food industry influencing consumer demand; contemporary topics in food marketing and policy; agricultural supply marketing; marketing research methods; marketing profitability measures; pricing; new product introduction; branding, and industry competitive analysis. Prerequisites: AGECE 1020 or ECON 1020 and MATH 1400. (Normally offered fall semester)

4060. Agribusiness Management. 3. Applies quantitative, economic, financial and managerial analysis to agribusiness sector. Prerequisites: AGECE 1020 and MATH 1400. (Normally offered fall semester)

4070. Agricultural Sales. 3. Applies transactional analysis for understanding human behavior in agribusiness sales. Introduces experimental learning and fundamentals of agribusiness sales. Prerequisites: AGECE 1020 and COJO 1010 or COJO 2010. (Normally offered spring semester)

4200. Gender and Race in the Economy. 3. [D♦♦(none)] Focuses on the role gender and race play in the economy; specifically the way that gender and race affect economic outcomes for individuals in the United States. Cross listed with WMST 4200. Dual listed with AGECE 5200. Prerequisites: AGECE 1020 or equivalent, or SOC 1000, or WMST 1080, and WB/COM2.

4230. Intermediate Econometric Theory. 3. Covers simple and multiple regression models, problems of estimation, hypothesis and diagnostic testing, dummy variable, autoregressive and distributed lag models, and time-series analysis. The objective is to understand the

underlying theory of econometric modeling and obtain operational ability to construct, estimate, and test econometric models. Cross listed with ECON 4230; dual listed with AGECE 5230. *Prerequisites:* ECON 3020, STAT 2050 or STAT 2070, and MATH 2350. (Normally offered spring semester)

4280. International Food and Farm Cultures. 3. [G♦(none)] Study-tour course in western France of lectures, fieldtrips, and other cultural activities are integrated into a curriculum to study sustainable food cultures and farming systems. Students live with host families and learn about current policies, belief systems and cultural practices that guide food production, consumption and marketing in Europe. *Prerequisite:* completion of WA/COM1 and I/FYS.

4450. Negotiation. 3. Examines how to use negotiation to resolve conflict and get agreement. Describes conflict; outlines ways to address conflict; examines different negotiation strategies and the impact of cognitive bias, power, ethics, and individual and cultural differences; and explores mediation practices. Students complete negotiations, role-plays, and questionnaires. Cross listed with ENR 4450. Dual listed with AGECE 5450. *Prerequisite:* completion of USP O/COM2 requirement; junior standing.

4460 [5460]. Agriculture and Economic Development. 3. Examines the roles of agriculture in the transformation of the economics of underdeveloped countries. Examines development theories, case studies and analytical techniques. *Prerequisites:* AGECE 1010, 1020 and a G course.

4500 [650]. Agricultural Finance. 3. Principles of financial management; compounding and discounting; leverage and capital budgeting and alternatives in resource control. *Prerequisite:* AGECE 1020 or equivalent. (Normally offered spring semester)

4550. Negotiation Analysis. 3. Focuses on using an analytical perspective for maximizing joint gains between negotiators. Students learn analytical techniques to prepare for negotiation, evaluate options and proposals during a negotiation, and evaluate negotiated outcomes with respect to maximization of joint gains and fairness criteria. Dual listed with AGECE 5550; Cross listed with ENR 4550. *Prerequisite:* QA/Q.

4600. Community Economic Analysis. 3. [(none)♦H] Analysis of regions and rural communities; their problems, socioeconomic characteristics, land use and economic development. Provides training in regional economic analysis, fiscal impact analysis and

benefit cost analysis. Dual listed with AGECE 5600. *Prerequisites:* ECON 3010, 3020, and MATH 1400.

4640. Advanced Farm/Ranch Management. 3. Tools of management decision-making applied to problems of farm-ranch management and resource acquisition and use. *Prerequisites:* AGECE 1020, 2020 and MATH 1400. (Normally offered spring semester)

4660. Community and Economic Development. 3. Community development from an interdisciplinary perspective, integrating theory, concepts and methods from sociology, economics, political science, and community development. Students learn how community theory can be used to design and support effective economic development programs. Includes readings, lectures, guest lectures, field trips and community analysis projects. Dual listed with AGECE 5660. *Prerequisites:* AGECE/ECON 1020 or SOC 2090 and junior standing.

4700. Economics of Range Resources. 3. Applies economic and decision theory to management and allocation of public and private range resources. *Prerequisite:* AGECE 1020 or equivalent. (Normally offered spring semester)

4710. Natural Resource Law and Policy. 3. Legal and economic examination of laws intended to resolve environmental conflicts. Surveys economic rationales both for private property and government intervention in environmental disputes; content of selected environmental laws in the U.S.; and basic principles of environmental mediation. *Prerequisites:* AGECE 1020, ECON 1020 or equivalent and 3 hours of business law or agricultural law. (Normally offered fall semester of even-numbered years)

4720. Water Resource Economics. 3. Presents principles and procedures appropriate to water resource allocation and development decisions. Studies agricultural, recreational, industrial and other uses of water. Includes a field trip. *Prerequisite:* AGECE 1020 or equivalent; QB course, WB course; senior standing. (Normally offered fall semester of even-numbered years)

4740. Agricultural Policy. 3. Identifies problems in agriculture and considers alternative programs. *Prerequisite:* AGECE 1020 or equivalent. (Normally offered spring semester of odd-numbered years)

4830. Agricultural Commodities and Futures Markets. 3. Economics of price determination for agricultural commodities and development of pricing strategies in cash and futures markets. *Prerequisite:* AGECE 1020 or equivalent. (Normally offered fall semester)

4840. Agricultural Market Analysis. 3. Applies economic theory to an analysis of economic organization and operation of agricultural markets, including price behavior. *Prerequisites:* MATH 1400 and ECON 3020. (Normally offered spring semester of odd-numbered years)

4880. International Agricultural Trade, Markets and Policy. 3. [G♦(none)] International agricultural commodity markets, product markets and market channels are characterized and examined. Presents economic theory relevant to description and analysis of international markets. Characterizes and analyzes historical and contemporary U.S. commercial trade policy and agricultural policy and their effect on markets. *Prerequisites:* AGECE 1010 and 1020 or equivalent and ECON 3020. (Normally offered spring semester of even-numbered years)

4890. Special Topics in _____. 1-3 (Max. 6). Accommodates seminar series or course offering by visiting faculty whose subject matter is not included in other courses. *Prerequisites:* junior standing and/or consent of instructor. (Offered based on sufficient demand and resources)

4910. Problems in Agricultural Economics. 1-3 (Max. 6). Consists of supervised study and investigation on topics of current importance in agricultural economics. *Prerequisites:* 12 hours in AGECE or ECON and consent of instructor.

4930. Agricultural Economics Internship. 1-6 (Max. 6). Provides practical agricultural business firm and/or agency experience. Develops working knowledge of how basic economic concepts are used by firms and agencies in policy and procedures development and decision making by the organization. *Prerequisites:* 10 hours of AGECE and approval of faculty supervisor.

4950. Senior Seminar and Thesis I. 1. [WC♦(none)] Beginning of preparation and presentation of senior research thesis relevant to agriculture economics field. *Prerequisites:* 15 hours of AGECE and/or ECON and WB/COM2 writing course.

4960. Senior Seminar and Thesis II. 2. [WC♦(none)] Final preparation and presentation of senior thesis and writing of final report. *Prerequisite:* AGECE 4950.

4965. Agribusiness Strategy and Ethics Capstone. 3. [WC♦COM3] Integrates economic theory, strategic management, and ethical principles into management decision analysis related to food, agricultural, and resource-based industries. Students develop the appropriate professional documents, interpersonal communication skills, and oral presentation skills to pursue career in agri-

business management. Emphasis is placed on refining students' professional writing abilities. *Prerequisites:* senior standing, 15 hours of AGECEC and/or ECON and WB/COM2 writing course.

4970. Technical Communication for Agribusiness. 3. [(none)♦COM3] This course is the senior capstone for agribusiness majors. Students will use written, oral, and digital communication appropriate for the discipline to complete a technical report and oral presentation on a complex topic affecting agriculture or natural resources.

5200. Gender and Race in the Economy. 3. Focuses on the role gender and race play in the economy; specifically the way that gender and race affect economic outcomes for individuals in the United States. Cross listed with WMST 5200. Dual listed with AGECEC 4200. *Prerequisites:* AGECEC 1020 or equivalent, or SOC 1000, or WMST 1080, and WB/COM2.

5230. Intermediate Econometric Theory. 3. Covers simple and multiple regression models, problems of estimation, hypothesis and diagnostic testing, dummy variables, autoregressive and distributed lag models, and time-series analysis. The objective is to understand the underlying theory of econometric modeling and obtain operational ability to construct, estimate, and test econometric models. Dual listed with AGECEC 4230. *Prerequisites:* ECON 3020, STAT 2050 and MATH 2350.

5310. Theory of Producer Behavior. 3. Economic models of optimization as they apply to firm-level production decisions. Topics include the properties of production functions, theories of linear and non-linear optimization, firm decision making under perfect and imperfect competition and firm decision making under uncertainty. *Prerequisites:* ECON 3020, STAT 2050 and MATH 2350.

5320. Quantitative Methods in Agricultural Economics. 3. Covers mathematical programming and simulation techniques for solving applied problems in agricultural economics. Emphasizes the formulation of economic research problems in quantitative terms and the use of computer software packages to derive solutions. *Prerequisites:* ECON 3020, STAT 2050 and MATH 2350.

5450. Negotiation. 3. Examines how to use negotiation to resolve conflict and get agreement. Describes conflict; outlines ways to address conflict; examines different negotiation strategies and the impact of cognitive bias, power, ethics, and individual and cultural differences; and explores mediation practices. Students complete negotiations, role-plays,

and questionnaires. Cross listed with ENR 5450. Dual listed with AGECEC 4450. *Prerequisite:* completion of USP O/COM2 requirement; junior standing or consent of instructor.

5550. Negotiation Analysis. 3. Focuses on using an analytical perspective for maximizing joint gains between negotiators. Students learn analytical techniques to prepare for negotiation, evaluate options and proposals during a negotiation, and evaluate negotiated outcomes with respect to maximization of joint gains and fairness criteria. Dual listed with AGECEC 4550; Cross listed with ENR 5550. *Prerequisite:* QA/Q.

5600. Community Economic Analysis. 3. Analysis of regions and rural communities; their problems, socioeconomic characteristics, land use and economic development. Provides training in regional economic theory, regional economic analysis, fiscal impact analysis and benefit cost analysis. *Prerequisite:* ECON 3010, 3020 and MATH 1400; or consent of instructor.

5630. Advanced Natural Resource Economics. 3. An in-depth treatment of theoretical issues, quantitative techniques, and institutional arrangements in the natural resource field. Topics include welfare economics, property rights, market failure and externalities, and benefit cost analysis. *Prerequisites:* ECON 3010 and 3020, STAT 2050 and MATH 2350.

5650. Research Methods. 1. Examines scientific methods as they specifically relate to a masters level research project in applied economics. This includes formulating the research question, developing hypotheses, determining a theoretical framework from which the data gathering and analysis will proceed and lead to reporting research outcomes. *Prerequisites:* ECON 3010 and 3020, STAT 2050.

5660. Community and Economic Development. 3. Community development from an interdisciplinary perspective, integrating theory, concepts and methods from sociology, economics, political science, and community development. Students learn how community theory can be used to design and support effective economic development programs. Includes readings, lectures, guest lectures, field trips and community analysis projects. Dual listed with AGECEC 4660. *Prerequisite:* AGECEC/ECON 1020 or SOC 2090 and junior standing.

5710. Advanced Agricultural Market Theory. 3. Theoretical foundations of the study of agricultural markets and how business is conducted in those markets. Topics include pure competition, industrial organization concepts

related to imperfect competition including game theory, principal-agent theory, transaction costs economics, intermediary theory, and welfare implications of alternative agricultural market structures. *Prerequisites:* ECON 3020 and MATH 2350.

5740. Consumer Behavior and Prices Analysis. 3. Focuses on microeconomic consumer theory and its application. Topics include utility theory, market demand theory, expected utility theory, and econometric applications. *Prerequisites:* ECON 3020, MATH 2350 and STAT 2050.

5880. Advanced Seminar. 1-2 (Max. 2). Involves reporting to the seminar group on research methods and results obtained in the investigation of a topic or question relevant to the field of agricultural economics. *Prerequisite:* 9 credits in AGECEC and/or ECON.

5890. Advanced Problems in Agricultural Economics. 1-3 (Max. 6). Supervised study and research on current problems in marketing, farm and ranch management, policy prices, land economics or finance. *Prerequisite:* graduate standing in AGECEC or ECON.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate status.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: Credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1-12 (Max. 24). Graduate level course 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:* enrolled in a graduate degree program.

5990. Internship. 1-12 (Max. 24). *Prerequisite:* graduate standing.

Department of Animal Science

101 Animal Science/Molecular Biology

Bldg., (307) 766-2224

FAX: (307) 766-2355

Web site: uwyo.edu/anisci

Department Head: Michael Day

Professors:

MICHAEL L. DAY, B.S. University of Missouri 1980; M.S. University of Nebraska 1982; Ph.D. 1985; Professor of Animal Science 2015.

STEPHEN P. FORD, B.S. Oregon State University 1971; M.S. West Virginia University 1973; Ph.D. Oregon State University 1977; Professor of Animal Science 2000.

BRET W. HESS, B.S. University of Nevada, Reno 1991; M.S. 1993; Ph.D. University of Missouri-Columbia 1996; Professor of Ruminant Nutrition 2008, 2002.

RICHARD J. MCCORMICK, B.S. University of Connecticut 1979; M.S. 1980; Ph.D. Kansas State University 1985; Professor of Animal Science 1997, 1985.

DANIEL C. RULE, B.S. University of California, Davis 1977; M.S. 1980; M.S. Washington State University; Ph.D. Iowa State University 1984; Professor of Animal Science 1999, 1987.

Associate Professors:

BRENDA M. ALEXANDER, B.S. University of Wyoming 1986; M.S. 1988; Ph.D. 1999; Associate Professor of Animal Science 2012.

SCOTT L. LAKE, B.S. University of Nevada 1998; M.S. 2001; Ph.D. University of Wyoming 2005; Associate Professor of Animal Science 2014, 2008. Extension Livestock Specialist.

PAUL A. LUDDEN, B.S. University of Nebraska-Lincoln 1991; M.S. Purdue University 1994; Ph.D. University of Missouri-Columbia 1997; Associate Professor of Ruminant Nutrition 2004, 1998.

WARRIE J. MEANS, B.S. Colorado State University 1979; M.S. 1982; Ph.D. 1985; Associate Professor of Animal Science 2002, 1992.

STEVEN I. PAISLEY, B.S. University of Wyoming 1993; M.S. 1995; Ph.D. Oklahoma State University 1998; Extension Beef Cattle Specialist; Associate Professor of Animal Science 2007, 2001.

Assistant Professors:

BLEDAR BISHA, D.V.M. Agricultural University of Tirana-Albania 1999; M.S. Iowa State University 2004; Ph.D. 2009; Assistant Professor of Animal Science 2013.

WEI GUO, B.S. College of Life Science 1999; Ph.D. China Agriculture University 2004; Assistant Professor of Animal Science 2013.

Academic Professional Lecturers:

CALEB BOARDMAN, B.S. Texas A&M University 2012; M.S. 2014; Academic Professional Lecturer 2015.

JENNIFER A. INGWERSON, B.S. University of Nebraska-Lincoln 2005; M.S. Iowa State University 2014; Academic Professional Lecturer 2014.

Adjunct Professors:

Kristi Cammack, Jeff Chandler, Thomas Hansen, John Johnston, Tom McDonald, Peter Nathanielsz, Mark Nijland, Heywood Sawyer, Donal Skinner, D. Paul Thomas, Meijun Zhu

Professors Emeriti:

Ray Field, Frank Hinds, Doug Hixon, Steven W. Horn, Conrad Kercher, Gary Moss, William Murdoch, Johannes Nel, Bibek Ray

The Department of Animal Science offers a variety of courses in animal and food science. The department uses modern laboratories and excellent animal facilities including a livestock teaching arena and a meat processing facility.

The Department of Animal Science and the Department of Veterinary Science have a combined curriculum, under Animal and Veterinary Science (ANVS). The curriculum has options in production, range livestock, business, communication, animal biology, preveterinary medicine, meat science and food technology, and equine science. The curriculum leads to a wide variety of career opportunities for animal and veterinary science graduates.

Animal and veterinary science

The Department of Animal Science and the Department of Veterinary Sciences have combined their efforts to offer several degree options leading to the bachelor of science degree in animal and veterinary science. Courses in animal science, food science, and pathobiology are the core offerings in the various options.

Agriculture, in its broadest definition, is the nation's largest industry. Livestock production is Wyoming's largest agricultural enterprise. Animal agriculture and its associated industries offer many opportunities for the interested student. Whether a student is interested in production livestock, allied fields such as meat science, business or animal health, or wants to apply to a college of veterinary medicine, the degree tracks offered will form the basis for a challenging career in animal agriculture/biology. The various options provide maximum flexibility to meet the chang-

ing needs of students and their employers. For students interested in pursuing advanced research, M.S. and Ph.D. degrees are offered.

Several degree options allow for specialization and graduate or professional school preparation. A brief description of each option and the educational opportunities they provide is given with the course requirements.

A grade of C or better must be earned in the following courses when the courses are required in the individual option for completion of the degree: ANSC 3010, 3100, 4120, 4540, 4630; FDSC 3060, PATB 4110, PATB 4111, LIFE 1010, 2022.

Students are encouraged to participate in activities related to their degree option. The university has livestock, horse and meats judging teams. Each team travels and participates in at least one major exposition a year. Each year, the Academic Quadrathlon competition is held, combining practical and classroom skills for students. Field trips, as practical teaching aids in many classes, are scheduled throughout the year. Internships are available to gain practical experience. Student organizations such as the Block and Bridle Club, Food Science Club, Microbiology Club, Range Club, and the Pre-vet Club provide additional educational and recreational opportunities.

Production Option

This option provides a strong background in livestock production and management. Students interested in livestock production should enroll in this option.

Animal and Veterinary Science.....

Required courses: ANSC 1010, 2020, 3010*, 3100*, 4120*, 4540*, 4630*

(COM3) and two courses selected from ANSC 3150, 4220, 4230, or 4240; PATB 4110*

Agricultural Sciences

Required courses: FDSC 2040, 3060*; AGE 1020, 2020; REWM 2000

Other math/science courses

Required courses: LIFE 1010* (PN), 2022*, 3050; CHEM 1000 (PN), ANSC 2010 or CHEM 2300, MATH 1400 (Q); STAT 2050 or 2070

Other communication courses.....

ENGL 1010* (COM1) and a COM2* course

Other University Studies courses

First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)

Required credits 128**

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Range Livestock Option

This option emphasizes range livestock management. Students interested in the management of livestock and range resources should enroll in this option.

Animal and Veterinary Science.....

Required courses: ANSC 1010, 3010*, 3100*, 2020 or 4100, 4120*, 4150, 4220, 4230 or 3150, 4540*, 4630* (COM3); PATB 4110*

Rangeland Ecology and Watershed

Management

Required courses: REWM 2000, 2500, 3500, 4000, 4330, 4900

Agricultural Sciences

Required courses: FDSC 2040, 3060*; AGECE 1020, 2020

Other math/science courses.....

Required courses: LIFE 1010* (PN), 2022*, 3050; CHEM 1000 (PN), ANSC 2010 or CHEM 2300, MATH 1400(Q); STAT 2050 or 2070

Other communication courses.....

ENGL 1010* (COM1) and a COM2* course

Other University Studies courses

First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)

Required credits 128**

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Business Option

Students desiring a strong background in business in addition to the basic courses in animal and veterinary science should enroll in this option. Graduates will be qualified for careers in the livestock agribusiness industry.

Animal and Veterinary Science.....

Required courses: ANSC 1010, 2020, 3010*, 3100*, 4120*, 4540*, 4630* (COM3) and two courses selected from ANSC 3150, 4220, 4230 or 4240; PATB 4110*

Agricultural Economics and Business.....

Required courses: AGECE 1010, 1020, 3860 or 4880; AGECE 4060 or MGT 3210; AGECE 4050 or MKT 3210; ACCT 1010

Agricultural Sciences

Required course: FDSC 3060*

Other math/science courses.....

Required courses: LIFE 1010* (PN), 2022*, 3050; CHEM 1000 (PN), ANSC 2010 or CHEM 2300, MATH 1400 (Q); STAT 2050 or 2070

Other communication courses.....

ENGL 1010* (COM1) and a COM2* course

Other University Studies courses

First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)

Required credits 128**

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Communication Option

Students in this option obtain a basic education in animal and veterinary science and also acquire in-depth communication skills. Students interested in careers in agriculture communications with emphasis on the livestock industry should enroll in this option.

Animal and Veterinary Science.....

Required courses: ANSC 1010, 2020, 3010*, 3100*, 4120*, 4540*, 4630* (COM3) and two courses selected from ANSC 3150, 4220, 4230, or 4240; PATB 4110*

Communication

Required courses: COJO 2010* (COM2), plus 14 additional credit hours in COJO

Agricultural Sciences

Required course: FDSC 3060*

Other math/science courses.....

Required courses: LIFE 1010* (PN), 2022*, 3050; CHEM 1000 (PN), ANSC 2010 or CHEM 2300, MATH 1400 (Q); STAT 2050 or 2070

Other communication course

ENGL 1010* (COM1)

Other University Studies courses

First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)

Required credits 128**

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Animal Biology Option

This option within the major requires more complete and stringent basic sciences. Students may complete premedical requirements or other pre-professional allied health requirements while completing a B.S. degree that prepares them for alternate career choices. Selected courses provide opportunity for more complete exposure in both biological sciences and pathobiology. Possible alternatives to professional schools include graduate school admission or employment by government or industry in research, promotion or sales.

Because of the variation in pre-professional requirements for different professional programs, students are encouraged to determine the specific requirements of the programs in which they are interested.

Animal and Veterinary Science.....

Required courses: ANSC 1010, 3010*, 3100*, 4120*, 4630* (COM3); PATB 4400

Agricultural Sciences

Required courses: FDSC 3060*; MICR/MOLB 2021 or 2240; MOLB 3610 and 4100 or MOLB 4600 and 4610

Other math/science courses.....

Required courses: LIFE 1010* (PN), 2022*, 3050; CHEM 1020 (PN), 1030, 2300 or CHEM 2420 and 2440; PHYS 1110, 1120; ZOO/PSYC 3600; MATH 1400, 1405, 2200 (Q); STAT 2050 or 2070

Other communication courses.....

ENGL 1010* (COM1) and a COM2* course

Other University Studies courses

First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)

Required credits 128**

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Meat Science and Food Technology Option

Students taking this option will have an excellent background for entering the meat industry. The food industry is the largest employer in this country and offers a wide variety of career opportunities.

Animal and Veterinary Science.....

Required courses: ANSC 1010, 3010*, 3100*, 4050, 4630* (COM3); PATB 4110*

Food Science	
Required courses: FDSC 1410, 2040, 3060*, 3062, 3063, 4090*, 4100, 4720*, 4771, 4772, 4773, 4774, 4900*	
Agricultural Sciences	
Required courses: AGEC 1020, AGEC 3860, MICR/MOLB 2021	
Other math/science courses	
Required courses: LIFE 1010* (PN), 2022*; CHEM 1000 (PN), ANSC 2010 or CHEM 2300, MATH 1400 (Q); Stat 2050 or 2070	
Other communication courses.....	
ENGL 1010* (COM1) and a COM2* course	
Other University Studies courses	
First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)	
Suggested courses.....	
FDSC 3061; FCSC 1141	
Required credits 128**	

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Pre-Veterinary Medicine Option

This option is especially designed to prepare students for application to colleges of veterinary medicine. There is a strong emphasis on the biological, biomedical and physical sciences. This curriculum is also appropriate for students wishing to pursue graduate school opportunities, other professional school applications, or careers in many areas of agribusiness. A minimum of three years of formal course work is required before one can apply to a college of veterinary medicine. Students accepted before completion of their B.S. degree can transfer credits back to UW to complete their degree requirements. Wyoming does not have a college of veterinary medicine. Faculty advisers insure that students meet the variable preveterinary requirements for application to colleges of veterinary medicine in their home state or region.

Animal and Veterinary Science.....	
Required courses: ANSC 3010*, 3100*, 4120*; one course selected from ANSC 3150, 4220 or 4230; PATB 4110*, 4400, 4500, 4710	
Agricultural Sciences	
Required courses: MICR/MOLB 2021, 2220; MOLB 3610	
Other math/science courses	
Required courses: LIFE 1010* (PN), 2022*, 3050; CHEM 1020 (PN), 1030, 2420, 2440; PHYS 1110, 1120; MATH 1400 (Q), 1405 (Q); STAT 2050 or 2070	

Other communication courses.....	
ENGL 1010* (COM1), a COM2* course, ANSC 4630* (COM3) or other COM3* course	
Suggested courses	
ANSC 4050, 4132, 4150, 4260, 4540; FDSC 3060; PATB 4001, 4130, 4170, 4360; ANSC/PATB 4111	
Other University Studies courses	
First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)	
Required credits 128**	

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Equine Science Option

This option provides a strong background in equine production and management. Students interested in equine should enroll in this option.

Animal and Veterinary Science.....	
Required courses: ANSC 1010, 1030, 3010*, 3100*, 3150*, 3250, 4120, 4132, 4250*, 4540*, 4630* (COM3); ANSC/PATB 4111*	
Agricultural Sciences	
Required courses: FDSC 2040; AGEC 2020; REWM 2000	
Horsemanship	
2 advisor/department head approved courses	
Other math/science courses	
Required courses: LIFE 1010* (PN), 2022*, 3050; CHEM 1000 (PN), ANSC 2010 or CHEM 2300, MATH 1400 (Q); STAT 2050 or 2070	
Other communication courses.....	
ENGL 1010* (COM1) and a COM2* course	
Other University Studies courses	
First-Year Seminar* (FYS), 2 courses in Human Culture (H), and U.S. and Wyoming Constitutions (V)	
Required credits 128**	

*A grade of C or better must be earned in these courses for successful completion of degree.

**Required credits: 128 total credit hours, 42 credit hours or more at the 3000-level or above.

Agriculture Education with Concurrent Major in Animal and Veterinary Science

This program consists of 128 total hours. Minimum 2.75 cumulative GPA and minimum 2.5 content GPA required. This major will be advised in the College of Education with

a secondary adviser in Animal Science. Refer to the College of Education for specific curriculum requirements.

Undergraduate Minor

The Departments of Animal Science and Veterinary Sciences offer a minor in animal and veterinary science for non-majors. The courses required for a minor must be taken for a letter grade and the student must receive a grade of C or better in each course. Courses required are: ANSC 3010, 3100, 4120, 4540; FDSC 3060; PATB 4110 and at least one of the following: ANSC 3150, 4220 or 4230. The Department of Animal Science or Veterinary Sciences undergraduate minor adviser may be contacted by students needing assistance or having questions.

Graduate Study

The Departments of Animal Science and Veterinary Science offer programs leading to the M.S. (Plan A and Plan B) and Ph.D. degrees in animal and veterinary science. A M.S. degree in food science and human nutrition is offered in cooperation with the Department of Family and Consumer Sciences. The Department of Animal Science also participates in the interdisciplinary M.S./Ph.D. Reproductive Biology Program which has morphed into Biomedical Science Program.

Program Specific Degree Requirements

Master's Program - Plan A (thesis)

The student, major professor, and graduate committee determine the program of study and research project, which meets the needs of the individual student. The candidate's graduate committee should be established and functioning by the time the student has completed 12 semester hours of formal coursework. The master of science program should be approved and filed by the end of the student's second semester of graduate study in animal science. This committee shall also determine if the student is making satisfactory progress to be advanced to a candidate for a master's degree or continued in a doctoral program by the end of the student's third semester following matriculation.

The student can specialize in breeding, food science and human nutrition, nutrition, physiology, meat science, reproduction or wool for coursework and thesis/dissertation project. In addition, supporting coursework is available in agricultural economics, biochemistry, microbiology, range management, genetics, statistics, and other areas of interest to the

individual. In certain cases it is possible to develop a joint research project between animal science and another department.

Students may use the research facilities and herds of beef cattle, sheep, and swine at the university livestock center near the university or at one of the university research and extension centers in the state. Research laboratories are located on campus and include a modern meat processing facility.

The Plan A program is a 30 hour program, 26 hours of coursework and 4 hours of thesis research.

Master's Program - Plan B (non-thesis)

The Plan B program requires a course-work-intensive, non-thesis master of science program for those students whose career paths may not require a thesis research program.

The program requires 32 hours of coursework in addition to an acceptable non-thesis research paper as defined by the student's graduate committee.

Doctoral Program

The program requires 72 hours. Students must follow minimum graduate requirements.

Animal Science (ANSC)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1009. Introduction to Animal Science for 4-H/Youth. 4. Introduction to the field of animal science, including meat and dairy products, nutrition, reproduction, breeding and genetics, livestock selection, and diseases and health of domestic livestock species, with application to the management of beef cattle, sheep and wool, dairy cattle, swine, and horses. Intended for high school undergraduates.

1010. Introduction to Animal Science. 4. Introduction to the field of animal science, including meat and dairy products, nutrition, reproduction, breeding and genetics, livestock selection, and diseases and health of domestic livestock species, with application to the management of beef cattle, sheep and wool, dairy cattle, swine, and horses. (Normally offered fall semester)

1030. Equine Management. 3. An overview of the horse industry and proper way to manage horses. (Normally offered spring semester)

1070. Livestock Fitting and Showing. 1. Teaches fitting and showing techniques for domestic livestock. Students will have the opportunity to fit an animal of their choice and

participate in the Little International Livestock Show at the Animal Science Livestock Center. (Normally offered fall semester)

2010. Domestic Animal Metabolism. 3. Integrates cellular and whole-animal metabolism through introduction to metabolic regulation. Introduces students to the nomenclature, structures and functions of cellular metabolites and vitamins. Knowledge of chemical structure will be applied to cellular reactions in various tissues of domestic animals. Ruminants and non-ruminants will be contrasted. *Prerequisite:* CHEM 1000. (Normally offered fall semester)

2020. Feeds and Feeding. 4. Nutrient classification and use, feed value, ration formulation and feeding domestic animals. (Normally offered fall semester)

2035. Companion Animal Nutrition. 3. Nutrition and biology of digestion of companion/pet animals. Fundamentals of nutrition and the nutrients, as well as appropriate terminology will be covered, with direct application to companion animals. (Normally offered spring semester)

3010. Comparative Anatomy and Physiology of Domestic Animals. 4. Teaches comparative anatomy and physiology of digestion, circulation, production, reproduction and environment of farm animals. *Prerequisites:* LIFE 1010 and 2022 with a minimum grade of C. (Normally offered spring semester)

3100. Principles of Animal Nutrition. 3. Description of the nutrients, nutrient digestion and absorption, and nutrient function within the body of various domesticated animals. *Prerequisite:* CHEM 2300 or ANSC 2010. (Normally offered spring semester)

3150. Equine Nutrition and Physiology. 3. Provides general knowledge of nutrition, physiology and biochemistry of exercise and reproductive processes of equine. *Prerequisite:* 4 hours of biology. (Normally offered fall semester)

3250. Equine Behavior and Welfare. 3. To familiarize students with an equine interest about behavior, learning, and welfare issues associated with management and training of equine. *Prerequisites:* ANSC 1030, ANSC 3150.

3545. Introduction to Livestock Evaluation. 3. Objectively evaluate livestock species including cattle, sheep, swine, and goats for both market and breeding standards. Improve communication skills and terminology through oral and written reasons. Gain an understanding of expected progeny differences and how they relate to selection and livestock production. *Prerequisite:* FDSC 2040 or instructor approval.

3550. Advanced Livestock Evaluation. 1-2 (Max. 3). Students representing the university in national and regional contests are selected from this course. Requires field trips. *Prerequisite:* ANSC 3545.

3555. Equine Evaluation and Selection. 3 (Max. 6). Objectively evaluate equine for performance and breeding purposes according to breed standards and or discipline. Emphasis will be placed on learning how conformation relates to overall function and longevity of equine. Competitive horse judging team criteria will be used to build organizational skills, equine terminology, and communication skills. *Prerequisites:* ANSC 1010 and ANSC 1030.

3560. Advanced Equine Evaluation and Selection. 1-2 (Max. 3). Objectively evaluate equine for halter and performance according to breed standards and or discipline. Competitive horse judging team criteria will be used to build organizational skills, equine terminology, and communication skills. Students will compete as members of the Collegiate Horse Judging Team and represent University of Wyoming at national horse judging competitions. *Prerequisites:* ANSC 3555.

3650. Exploring Graduate Study in Animal Science. 1. Gives undergraduates the opportunity to explore graduate studies in Animal Science. Discussions center on graduate program searches, applications, and interviews as well as graduate student responsibilities and career possibilities. Undergraduates are paired with graduate student mentors, participate in data collection, and attend departmental seminars. *Prerequisites:* consent of instructor, junior standing and 3.0 GPA or higher recommended.

4050. Animal Growth and Development. 3. Explores aspects of animal growth and development, with a focus on skeletal muscle, adipose, soft connective tissues, and bone. Addresses genetic, endocrine, nutritional, and environmental impacts on tissue development and growth. Dual listed with ANSC 5050. *Prerequisite:* LIFE 2022.

4061. Cell Signaling. 3. Cell signaling pathways in animal growth and development. Defines how cells respond to external stimuli. Includes: G-protein couple signaling, calcium signaling, growth factor associated signaling, redox signaling, lipid related signaling, and apoptosis. Dual listed with ANSC 5061. *Prerequisites:* MOLB 3610 or an equivalent biochemistry or cell biology course. (Normally offered fall semester)

4100. Nutritional Management. 3. Integration and application of the principles of nutrition. Addresses nutrient requirements, feed composition and nutritional value, in addition to feeding management strategies for various

classes of farm animals. Provides practical nutritional experience through laboratory. Dual listed with ANSC 5100. *Prerequisite:* ANSC 3100. (Normally offered fall semester)

4111. Equine Health and Disease. 3. To familiarize students with identification, prevention and treatment of diseases in horses through proper health management techniques. Dual listed with ANSC 5111. Cross listed with PATB 4111. *Prerequisites:* ANSC 1030, ANSC 3150. (Normally offered spring semester)

4120. Principles of Mammalian Reproduction. 3. Overview of the anatomy, physiology, endocrinology and biochemistry of reproductive processes in male and female mammals. Dual listed with ANSC 5120. *Prerequisite:* a course in systemic anatomy and physiology/endocrinology. (Normally offered fall and spring semesters)

4130. Management of Reproduction. 3. Lecture-laboratory course. Introduces methods of manipulating reproduction within livestock management systems. Includes artificial insemination, diagnosis of pregnancy, induction and control of estrus and ovulation, induction of parturition, embryo transfer and control and prevention of diseases. *Prerequisite:* ANSC 4120. (Normally offered spring semester)

4132. Equine Reproduction. 2. Introduces methods of manipulating reproduction within equine management systems. Includes artificial insemination, diagnosis of pregnancy, induction and control of estrus and ovulation, parturition, embryo transfer, and control and prevention of equine reproductive diseases. *Prerequisites:* ANSC 4120 and ANSC 3150. (Normally offered spring semester)

4150. Physiology of Ruminant Digestion. 3. Anatomical structure, function and symbiotic relationship of ruminant digestive system. Dual listed with ANSC 5150. *Prerequisite:* ANSC 3100. (Normally offered fall semester)

4210. Wool Structures and Properties. 2. Chemical structure and reactions of wool fiber, as well as physical properties as related to structure. *Prerequisite:* CHEM 2300 or equivalent. (Offered based on sufficient demand and resources)

4220. Advanced Beef Production and Management. 3. Integrates animal breeding, nutrition and reproductive physiology in beef production management schemes. Emphasizes analysis and decision making. Consists of two hours of lecture and two hours of lab, with approximately one-half of labs meeting at Animal Science Livestock Center. *Prerequisites:* ANSC 3100, 4120, 4540. (Offered based on sufficient demand and resources)

4230. Advanced Sheep Production Management. 3. Integrates animal breeding, nutrition and reproductive physiology in sheep production management schemes. *Prerequisites:* ANSC 3100, 4120, 4540. (Normally offered spring semester)

4240 [3330]. Advanced Swine Production and Management. 3. Integrates animal breeding, nutrition and reproductive physiology in swine production management schemes. Consists of two hours of lecture and two hours of lab, with at least one-half of labs meeting at Animal Science Livestock Center. *Prerequisites:* ANSC 3100, 4120, or 4540. (Normally offered fall semester)

4250. Advanced Equine Production and Management. 3. A capstone course for students wanting to pursue a career in the equine industry with main focus on equine management. Business applications, health, facilities, and management will be explored in depth. Integrates equine breeding, nutrition, and reproductive physiology in equine production management schemes. *Prerequisites:* ANSC 1300, 3100, 4120, and 4540. (Normally offered spring semester)

4260. Mammalian Endocrinology. 3. Introduces principles of endocrinology, role of endocrine systems in regulating metabolism, growth, reproduction and lactation in mammals. Dual listed with ANSC 5260. *Prerequisite:* ANSC 3010, ZOO 2110 or 4220. (Normally offered spring semester)

4500. Problems in Animal Science. 1-3 (Max. 6). Provides opportunity for students to conduct supervised research in breeding, genetics, management, nutrition and physiology. *Prerequisites:* 6 hours in animal science and consent of instructor. (Offered fall, spring and summer)

4540. Principles of Animal Breeding. 3. Discusses genetic principles underlying animal improvement; introductory population genetics; heritability; systems of mating; and selection. Dual listed with ANSC 5540. *Prerequisite:* STAT 2050 or 2070. (Normally offered fall semester)

4550. Internship in Animal Science. 1-8 (Max. 8). Provides opportunities to acquire experience in a field of interest to the student. Offers learning experiences that are difficult, if not impossible, to realize in classroom settings. Following off-campus educational experience, students are more able to evaluate potential career opportunities and select additional classes on-campus to complement career direction. Offered S/U grade only. *Prerequisites:* sophomore standing; 2.5 GPA. (Offered fall, spring and summer)

4630. Topics and Issues in Animal Science. 3. [WC♦COM3] Writing-intensive course that focuses on writing projects related to current topics and issues in animal science. Emphasizes writing skills, strategies, information gathering and critical judgment. Assignments include short and long papers, resumes, letters of transmittal, and oral presentations. *Prerequisites:* senior standing and completion of WA and WB or COM1 and COM2 requirements. (Offered spring semester)

4700. Behavior of Domestic Animals. 2. Applied ethology emphasizing the behavioral biology of domestic and companion animals with a concentration on causes and treatments of unwanted behaviors. Ethological approaches include evolutionary, genetic, neural, and hormonal considerations. The foundations of classical and operant conditioning are discussed in relation to behavior modification techniques. *Prerequisites:* LIFE 2022 or equivalent; ANSC 3010. (Offered based on sufficient demand and resources)

4900. Undergraduate Teaching Practicum. 1-2 (Max. 4). Participation of undergraduates in the teaching of ANSC or FDSC courses under the supervision of ANSC faculty/staff. Offered Satisfactory/Unsatisfactory only. *Prerequisites:* junior standing and consent of instructor. (Offered fall, spring and summer)

5050. Animal Growth and Development. 3. Explores aspects of animal growth and development, with a focus on skeletal muscle, adipose, soft connective tissues, and bone. Addresses genetic, endocrine, nutritional, and environmental impacts on tissue development and growth. Dual listed with ANSC 4050. *Prerequisite:* LIFE 2022.

5061. Cell Signaling. 3. Cell signaling pathways in animal growth and development. Defines how cells respond to external stimuli. Includes: G-protein couple signaling, calcium signaling, growth factor associated signaling, redox signaling, lipid related signaling, and apoptosis. Dual listed with ANSC 4061. *Prerequisite:* MOLB 3610 or an equivalent biochemistry or cell biology course. (Normally offered fall semester)

5100. Nutritional Management. 3. Integration and application of the principles of nutrition. Addresses nutrient requirements, feed composition and nutritional value, in addition to feeding management strategies for various classes of farm animals. Provides practical nutritional experience through laboratory. Dual listed with ANSC 4100. *Prerequisite:* ANSC 3100. (Normally offered fall semester)

5111. Equine Health and Disease. 3. To familiarize students with identification, prevention and treatment of diseases in horses through proper health management techniques. Dual listed with ANSC 4111. Cross listed with PATB 5111. *Prerequisites:* ANSC 1030, ANSC 3150.

5120. Principles of Mammalian Reproduction. 4. In addition to attendance in the lecture component of this course, graduate students will be expected to participate in in-depth weekly discussions of the scientific literature and to prepare a research grant proposal on a specific topic. Dual listed with ANSC 4120. *Prerequisite:* a course in systemic anatomy and physiology or consent of instructor.

5150. Physiology of Ruminant Digestion. 3. The anatomical structure, function, and symbiotic relationship of the ruminant digestive system. Dual listed with ANSC 4150. *Prerequisite:* ANSC 3100.

5170. Feed and Food Analysis. 3. A lecture-laboratory course designed to provide students in animal science, food science and nutrition with instruction and hands-on experience with proximate analysis and instrumentation used for nutrient analysis of foods and feedstuffs as well as discussion of sampling, dilutions, and calculations. Cross listed with FDSC 5170. *Prerequisite:* 6 credits in chemistry or biochemistry, or consent of instructor.

5180. SAS Applications in Agriculture. 2. Use of PC Statistical Analysis (SAS) software for analysis of data generated using experimental designs common to the agricultural sciences. Course will emphasize applied programming and interpretation of results. *Prerequisite:* STAT 5080 or equivalent.

5260. Mammalian Endocrinology. 3. Introduction to the principles of endocrinology. The role of endocrine systems in regulating metabolism, growth, reproduction, and lactation in mammals are discussed. Dual listed with ANSC 4260. *Prerequisite:* ANSC 3010. (Normally offered spring semester)

5510. Mineral Metabolism. 3. Lectures on current mineral nutrition topics with student reports on recent journal articles. *Prerequisite:* ANSC 3100.

5530. Topics in Range Nutrition. 3. Lectures on current range nutrition topics with student reports on recent journal articles. *Prerequisite:* ANSC 3100 and consent of instructor.

5540. Principles of Animal Breeding. 3. Discusses genetic principles underlying animal improvement; introductory population genetics; heritability; systems of mating; and selection. Dual listed with ANSC 4540. (Normally offered fall semester)

5550. Investigations in Animal Nutrition. 2-3 (Max. 6). Special problems involving nutritional research with domestic or laboratory animals. *Prerequisite:* ANSC 3100 and consent of instructor.

5620. Wool Measurement Methods. 3. Theory and practice relating to routine and standard analytical fiber measurements. *Prerequisite:* ANSC 3040 and STAT 2050 or consent of instructor.

5680. Wool Problems Analysis. 1-5 (Max. 10). Scientific papers on assigned topics. *Prerequisite:* STAT 2050.

5770. Lipid Metabolism. 3. An in-depth study of lipid metabolism and regulation of genes and enzymes involved in transport, synthesis, mobilization, and oxidation of lipids with application to ruminant and non-ruminant species as well as to humans. Cross listed with FDSC 5770. *Prerequisite:* ANSC 3100 or MOLB 3610 or FCSC 4145.

5780. Investigations in Animal Breeding. 1-3 (Max. 6). Assigned problems involving genetic and physiological research with domestic or laboratory animals. *Prerequisite:* ANSC 4550.

5790. Investigations in Animal Physiology. 2-3 (Max. 6). Special problems involving reproductive physiology or other physiology research with domestic or laboratory animals. *Prerequisite:* ANSC 3010, 4120 and consent of instructor.

5865. Advanced Seminar in Nutrition. 1-2 (Max. 2). Preparation and presentation of seminars on a variety of topics relating to animal nutrition, metabolism, and livestock production. *Prerequisites:* graduate standing.

5870. Reproductive Biology Seminar. 1 (Max. 12). A graduate seminar designed to examine a variety of topics relating to the physiological processes of reproduction in mammals. *Prerequisite:* graduate standing.

5880. Advanced Topics. 1-3 (Max. 6). Special topics will be offered based on interest of students and faculty. Credit hours are variable 1-3 and are repeatable. *Prerequisite:* graduate standing.

5890. Advanced Seminar. 1-2 (Max. 6). Preparation, presentation, and discussion of assigned reports. Invitational lectures by visiting guests.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate status.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: Credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1-12 (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. *Prerequisites:* enrolled in a graduate degree program.

5961. Graduate Project. 1-4 (Max. 4). Limited to those students enrolled in a Plan B graduate program. Students should be involved in non-course scholarly activities in support of the Plan B project. *Prerequisites:* must be enrolled in Plan B program and have departmental approval.

5980. Dissertation Research. 1-12 (Max. 48). Graduate level course 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.

5990. Internship. 1-12 (Max. 24). *Prerequisite:* graduate standing.

Food Science

Food science is the application of basic sciences to the processing, quality control, storage, distribution and consumer use of food products. The microbiological, chemical and physical characteristics of foods as related to food processing and product quality are studied. Major emphasis is placed in the area of animal food products.

Food Science (FDSC)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦♦Q]).

1101. First-Year Seminar. 3. [(none)♦♦FYS]

1410. Food and Our Well Being. 3. Introductory course dealing with current questions and concerns about foods. Considers food composition, effects of food processing, food labeling, diet, degenerate diseases and general health. Students become familiar with foods and food industry. (Normally offered spring semester)

1490. Safety of Our Food. 4. For students interested in knowing what makes a food, the most basic necessity of life, safe or unsafe. This

will be explored through discussions on factors that make a food safe or unsafe, risk-benefit concepts, the real safety issues and the role of regulatory agencies and consumers to ensure safety of food. When possible, outside experts will be invited to give their views during which students will be encouraged to discuss the issues. Laboratory is required. Course credit cannot be applied toward degree requirements in food science. (Offered once a year)

2040. Principles of Meat Animal Evaluation. 3. Live animal and carcass evaluation of beef, sheep and swine. Slaughter, meat inspection and anatomy are discussed. (Normally offered spring semester)

3060. Principles of Meat Science and Muscle Biology. 3. Principles of muscle, adipose, and connective tissue growth, structure and metabolism; conversion of muscle into meat; fresh meat properties and quality; chemical properties of meat; meat microbiology, preservation and storage; meat by-products; HACCP. *Prerequisites:* STAT 2050 or 2070. (Normally offered fall semester)

3061. Livestock Slaughter Practicum. 1. Students learn and practice proper techniques of livestock slaughter. *Prerequisite:* FDSC 3060 or concurrent enrollment.

3062. Carcass Fabrication Practicum. 1. Students learn and practice proper techniques of carcass fabrication. *Prerequisite:* FDSC 3060 or concurrent enrollment.

3063. Meat Processing Practicum. 1. Students learn and practice proper procedures for the production of sausages and cured meat products. *Prerequisite:* FDSC 3060 or concurrent registration.

3545. Introduction to Meat Judging. 3. USDA grading standards, value pricing, yield and quality attributes of meat are used to evaluate products. Improve communication skills and terminology through oral and written reasons. Requires field trips. *Prerequisite:* FDSC 2040.

3550 [2100]. Advanced Meat Judging. 1-2 (Max. 3). Students representing the university in national and regional contests are selected form this course. Requires field trips. *Prerequisite:* FDSC 3545.

4090. Food Microbiology. 3. Discusses microorganisms and theory of their growth and survival in relation to spoilage and preservation of foods and health hazards in foods. Dual listed with FDSC 5090; cross listed with MICR 4090. *Prerequisite:* MOLB 2210. (Normally offered spring semester)

4100 [610]. Laboratory Techniques in Food Microbiology. 1. Lab techniques used in food microbiology. Dual listed with FDSC 5100; cross listed with MICR 4100. *Prerequisite:* FDSC 4090 or 5090, taken concurrently. (Normally offered spring semester)

4720. Food Chemistry. 3. Studies chemical composition of foods and food products. Emphasizes processing and storage. Dual listed with FDSC 5720. *Prerequisite:* CHEM 2300. (Normally offered fall semester)

4771. Muscle Structure and Function. 1. Explores properties of skeletal muscle with emphasis on cellular and extracellular proteins, ultrastructure and function. *Prerequisite:* FDSC 3060 or equivalent.

4772. Conversion of Muscle to Meat. 1. Explores molecular and biochemical changes in postmortem muscle and their impact on meat quality. *Prerequisite:* FDSC 3060 or equivalent.

4773. Advanced Meat Processing. 1. Explores chemical and physical properties of meat and non-meat ingredients and their effect on meat processing. *Prerequisite:* FDSC 3060 or equivalent.

4774. Advanced Concepts in Meat Microbiology. 1. Explores spoilage and pathogenic microorganisms in meat products, including shedding, virulence, resistance, and detection methods. *Prerequisite:* FDSC 3060 or equivalent.

4800. Problems in Food Science. 1-3 (Max. 6). Examines special problems related to quality control, formulation and processing of meat, poultry and dairy foods. Offers research techniques and instrumentation in foods. *Prerequisites:* 6 hours in FDSC, 6 hours in chemistry and consent of instructor. (Offered fall, spring and summer)

4900. Food Safety. 3. Issue-oriented lecture/discussion course. Includes topics such as what is safe food, what makes food unsafe and how safety of a food is determined. Presents laws and regulations on food safety. In addition to a text, area experts are invited to discuss important issues. *Prerequisite:* 6 hours of biological science. (Offered fall semester of odd-numbered years)

4990. Undergraduate Teaching Practicum. 1-2 (Max. 4). Participation of undergraduates in the teaching of FDSC courses under the supervision of faculty/staff. Offered Satisfactory/Unsatisfactory only. *Prerequisite:* junior standing or consent of instructor.

5090. Food Microbiology. 3. Discusses microorganisms and theory of their growth and survival in relation to spoilage and preservation of foods and health hazards in foods. Dual listed with FDSC 4090. *Prerequisite:* MOLB 2210.

5100. Food Microbiology Laboratory. 1. Laboratory techniques used in food microbiology. Dual listed with FDSC 4100. *Prerequisite:* FDSC 4090 or 5090, taken concurrently.

5170. Food Analysis. 3. A lecture-laboratory course designed to provide students in animal science, food science and nutrition with instruction and hands-on experience with proximate analysis and instrumentation used for nutrient analysis of foods and foodstuffs as well as discussion of sampling, dilutions, and calculations. Cross listed with ANSC 5170. *Prerequisite:* six credits in chemistry or biochemistry.

5220. Techniques of Food Science. 3. A laboratory course designed to introduce undergraduate and graduate students to sophisticated techniques used in food science research. *Prerequisites:* one semester of graduate study and consent of instructors.

5720. Food Chemistry. 3. A study of the chemical composition of foods and food products with emphasis upon processing and storage. Dual listed with FDSC 4720. *Prerequisite:* CHEM 2300.

5770. Lipid Metabolism. 3. An in-depth study of lipid metabolism and regulation of genes and enzymes involved in transport, synthesis, mobilization, and oxidation of lipids with application to ruminant and non-ruminant species as well as to humans. Cross listed with ANSC 5770. *Prerequisite:* ANSC 3100 or MOLB 3610 or FCSC 4145.

5771. Muscle Structure and Function. 1. Explores properties of skeletal muscle with emphasis on cellular and extracellular proteins, ultrastructure and function. Dual listed with FDSC 4771. *Prerequisite:* FDSC 3060 or equivalent.

5772. Conversion of Muscle to Meat. 1. Explores molecular and biochemical changes in postmortem muscle and their impact on meat quality. Dual listed with FDSC 4772. *Prerequisite:* FDSC 3060 or equivalent.

5773. Advanced Meat Processing. 1. Explores chemical and physical properties of meat and non-meat ingredients and their effect on meat processing. Dual listed with FDSC 4773. *Prerequisite:* FDSC 3060 or equivalent.

5774. Advanced Concepts in Meat Microbiology. 1. Explores spoilage and pathogenic microorganisms in meat products, including shedding, virulence, resistance, and detection methods. Dual listed with FDSC 4774. *Prerequisite:* FDSC 3060 or equivalent.

5880. Advanced Problems and Topics. 1-3 (Max 6). Designed to allow graduate students to pursue advanced research problems and ad-

vanced topics and to obtain experience in the teaching process. *Prerequisite:* graduate standing and consent of instructor.

5890. Seminar in Food Science and Nutrition. 1. A seminar course on topics in food science and human nutrition. Dual listed with FDSC 4890. *Prerequisite:* graduate standing.

5900. Practicum in College Teaching. 1-3 (Max 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate standing.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: credit in this course may NOT be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1-12 (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. 1-12 (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. *Prerequisites:* enrolled in a graduate degree program.

5990. Internship. 1-12 (Max. 24). *Prerequisite:* graduate standing.

The Department of Veterinary Sciences section, including Pathobiology course offerings begins on page 143.

Department of Ecosystem Science and Management

2013 Agriculture Building,

(307) 766-2263

FAX: (307) 766-6403

Web site: uwo.edu/esm

Department Head: Scott N. Miller

Professors:

ANN L. HILD, B.A. University of Iowa 1975; M.S. Texas Tech University 1991; Ph.D. 1995; Professor of Rangeland Ecology and Watershed Management 2008, 1996.

DAVID E. LEGG, B.S. University of Missouri 1978; M.S. 1980; Ph.D. University of Minnesota 1983; Professor of Entomology 2003, 1988.

KATTA J. REDDY, B.S. A.P. Agricultural University (India) 1978; M.S. 1980; Ph.D. Colorado State University 1986; Professor of Water Quality 2006, 2000.

SCOTT R. SHAW, B.S. Michigan State University 1977; M.S. University of Maryland 1981; Ph.D. 1984; Professor of Entomology 1998, 1989.

PETER D. STAHL, B.S. Oklahoma State University 1978; M.S. University of Wyoming 1982; Ph.D. 1989; Professor of Restoration Ecology 2009, 2000; Director, Wyoming Reclamation and Restoration Center.

JOHN A. TANAKA, B.S. Oregon State University 1978; M.S. 1982; Ph.D. Utah State University 1986; Professor of Rangeland Ecology and Watershed Management 2009.

DAVID G. WILLIAMS, B.A. University of Texas 1985; M.S. Texas A&M University 1988; Ph.D. Washington State University 1992; Professor of Rangeland Ecology and Watershed Management 2009, 2002.

Associate Professors:

JEFFREY L. BECK, B.S. Brigham Young University 1993; M.S. 1996; Ph.D. University of Idaho 2003; Associate Professor of Rangeland Ecology and Watershed Management 2013, 2007.

TIMOTHY R. COLLIER, B.S. University of California—Riverside 1987; Ph.D. University of California—Santa Barbara 1994; Associate Professor of Entomology 2008, 2002.

ALEXANDRE V. LATCHININSKY, B.S. St. Petersburg State University (Russia) 1979; M.S. 1980; Ph.D. University of Wyoming 2001; Associate Professor of Entomology 2008, 2003.

SCOTT N. MILLER, B.S. Brown University 1991; M.S. University of Arizona 1995; Ph.D. 2002; Associate Professor of Rangeland Ecology and Watershed Management 2008, 2002.

JAY B. NORTON, B.S. University of Montana 1985; M.S. Iowa State University 1996; Ph.D. University of Montana 2000; Associate Professor of Soil Science 2012.

VIRGINIA B. PAIGE, B.A. Colorado College 1984; M.S. University of Massachusetts 1992; Ph.D. University of Arizona 2000; Associate Professor Rangeland Ecology and Watershed management 2009, 2004.

J. DANIEL RODGERS, B.S. East Texas State University 1963; M.S. Texas Tech University 1966; Ph.D. Utah State University 1980; Associate Professor of Rangeland Ecology and Watershed Management 1980.

THIJS KELLENNERS, B.S. Wageningen University, The Netherlands 1988; M.S. 1993; Ph.D. 2001. Associate Professor 2012.

JAMES W. WAGGONER, JR., B.S. New Mexico State University 1970; M.S. 1972; Ph.D. University of Illinois 1975; Associate Professor of Rangeland Ecology and Watershed Management 1994.

Assistant Professors:

KRISTINA HUFFORD, Assistant Professor of Rangeland Ecology and Watershed Management 2010.

MELANIE MURPHY, B.S. University of Idaho 1998; M.S. 2001; Ph.D. Washington State University 2008; Assistant Professor of Rangeland Ecology and Watershed Management 2010.

J. DEREK SCASTA, B.S. Texas A&M University 2004; M.S. 2008; Ph.D. Oklahoma State University 2014; Assistant Professor of Rangeland Ecology and Watershed Management 2014.

LINDA VAN DIEPEN, B.S. Hogeschool IJsselland, Deventer 1999; M.S. Wageningen University 2002; Ph.D. Michigan Technological University 2008; Associate Professor of Soil Microbiology 2015.

KAREN L. VAUGHAN, B.S. University of Delaware-Newark 2001; M.S. University of Maryland-College Park 2004; Ph.D. University of Idaho-Moscow 2008; Assistant Professor of Pedology 2015.

MENGQIANG ZHU, B.E. North China Electric Power University 2002; M.S. Chinese Academy of Sciences 2005; Ph.D. University of Delaware 2010; Assistant Professor of Soil and Environmental Biogeochemistry 2013.

Academic Professionals:

CRAIG COOK, B.S. University of Utah 1978; Assistant Research Scientist, Stable Isotope Facility Manager.

SCOTT SCHELL, B.S. University of Wyoming 1991; M.S. 1994; Assistant Extension Entomologist 2005, Associate Research Scientist 2009.

CALVIN STROM, Research Scientist 2010.

Adjunct Professors:

Justin Derner, Jack Morgan, Brenda Schladoweiler, Gerald Schuman, Nancy Shaw, Ramesh Sivanpillai

Professors Emeriti:

Robert Heil, William Laycock, John Lloyd, Larry Munn, Richard Olson, Quentin Skinner, Michael Smith, Thomas Thurow, George Vance, James Wangberg, Thomas Wesche, Stephen Williams

The Department of Ecosystem Science and Management offers two programs leading to a Bachelor of Science degree. These are Rangeland Ecology

and Watershed Management and Agroecology (an interdepartmental program offered through the Department of Ecosystem Science and Management and the Department of Plant Sciences). The coursework requirements necessary for obtaining an agroecology degree are described in the Department of Plant Sciences section of this publication. Either degree can also be obtained as an affiliate degree in conjunction with the School of Environment and Natural Resources. Six minor degree programs are offered through the department: Insect Biology, Rangeland Ecology and Watershed Management, Soil Science, Agroecology, Forest Resources, and Reclamation and Restoration Ecology. Obtaining a minor to complement a B.S. major degree program provides credentials and knowledge that can expand career opportunities.

The degree programs reflect the department's diverse expertise in natural resource and agriculture sciences. Students completing degrees offered through the department are well prepared for careers in natural resource management and sustainable agriculture (e.g., range management, watershed management, restoration ecology/reclamation of degraded land, wildlife habitat management, biocontrol/integrated pest management, soil science and various types of environmental consulting) or other science careers.

Student Learning Outcomes

The goal of the Department of Ecosystem Science and Management is to provide students with a comprehensive knowledge in several different areas in addition to their specific area of study. These expectations ensure that students may take these learned skills and successfully apply them in their post-graduate endeavors. Assessments in all areas are based on knowledge, skills, and attitude.

These areas include:

Oral communication encompasses all the abilities necessary for effective expression and sharing of information, ideas, and feelings in a format including verbal and nonverbal symbols.

Proficiency in written communication will ensure that students will be able to write for different audiences, from expressive writing to technical writing, using a range of sophistication in language.

Professional behavior involves attaining high standards of behavior and appropriate attitudes, not only through acquiring knowledge and experience, but a lifelong commitment to learning and achievement.

Competency in critical thinking and problem solving will enable students to engage in reasonable, reflective thinking focused on deciding what to believe or do.

Computer and information literacy ensures that students will be viewed as trainable and adaptable in a computerized work environment. Proficiency in this area also enables students to effectively access online information, and skillfully make use of it.

The results in these different areas will aid the department in:

Planning instructional strategies to address student strengths and weaknesses;

Evaluating and describing overall student achievement;

Counseling students for academic and career options; and

Evaluating the effectiveness of instructional programs.

Minor in Forest Resources

The primary goal of the Forest Resources minor degree program is to develop a working knowledge of the processes that influence provision of the key products derived from forest lands. Courses taken in fulfillment of a major degree program will also be able to be applied to a minor degree program.

Hrs.

Minimum Requirements 20

RNEW 2100, SOIL 4150, RNEW 4775, and REWM 4540. Choose one from REWM 3100, REWM 4285, REWM 4700, or GEOG 4420; choose one from GEOG 2550 or REWM 4103; choose one from REWM 2000, ZOO 2450, RNEW 3000, or GEOG 4470.

Minor in Reclamation and Restoration Ecology

This program covers the use of basic and applied ecological concepts to rehabilitate and restore processes and functions to disturbed ecosystems.

Hrs.

Required Courses 14
LIFE 3400, SOIL 2010, REWM 4200, 4580, RNEW 4990

Planning and Policy (choose one).....3

AGEC 4710, ENR 3000, GEOG 4040, 4750, REWM 4051, 4052, 4900

Below-Ground Processes

(choose one) 3-4

CE 4800, 4820, SOIL 4100, 4120, 4140, 4150, 4160

Above-Ground Processes

(choose one) 2-4

BOT 4700, 4111, ENTO 4678, 4685,

GEOG 4200, REWM 4285, 4540, 4700, 4710, 4850, ZOO 4550

Total

22-25

Graduate Study

The Department of Ecosystem Science and Management is an interdisciplinary department made up of five disciplinary areas: entomology, rangeland ecology, soil sciences, agroecology, and watershed management. The department offers the master of science and doctor of philosophy degrees in entomology, rangeland ecology and watershed management, and soil science. A water resources dual major may be obtained in conjunction with each of these master's degrees. For the rangeland ecology and watershed management degrees, thesis and dissertation problems may be developed in aspects of range ecology, wildlife habitat, reclamation of disturbed lands, watershed management, utilization and improvement of rangelands, and many other facets of range and forest ecology management. For the entomology degrees, thesis and dissertation problems may be developed in many areas of basic and applied aspects of insect ecology. For the soil degrees, thesis and dissertation problems may be developed in many basic and applied aspects of soil science. The degree programs reflect the department's diverse expertise in natural resource and agriculture sciences. Students completing degrees offered through the department are well prepared for careers in natural resource management and sustainable agriculture (e.g., range management, watershed management, restoration ecology/reclamation of degraded land, wildlife habitat management, biocontrol/integrated pest management, soil science and various types of environmental consulting) or other science careers.

A graduate certificate in reclamation and restoration ecology may be obtained after completion of a B.S. degree or in conjunction with an M.S. or Ph.D. degree.

At present, no program for graduate degrees in agroecology is offered; however, some courses at the graduate level are available. Responsibility for this program is shared with the Department of Plant Sciences.

Program Specific Admission Requirements

Admission is contingent upon a faculty member being willing to assume responsibility for working with the student as an adviser.

Applicants are encouraged to initiate correspondence with faculty who share similar research interests as part of the process of securing faculty advising commitment.

In special circumstances, and with the faculty adviser's support, a student may be admitted in a provisional status with continued enrollment dependent upon meeting performance requirements specified at the time of admission.

Program Specific Graduate Assistantship Information

Current graduate assistantship availability, subject of study, and remuneration can be determined by checking: www.uwyo.edu/esm. Prospective students are also encouraged to directly correspond about future opportunities for graduate assistantships with faculty that share similar research interests.

Program Specific Degree Requirements

Master of Science in Entomology

Plan A (thesis)

The master of science degree normally is offered under Plan A which requires at least the university minimum degree requirements and an oral examination.

Plan B (non-thesis)

Requires 30 hours of graduate credit to include 9 hours of required courses, 11 hours of required electives, and 10 hours of other electives.

Plan B project - follows format of Plan A thesis.

A Plan B master of science will be a terminal degree program in the Department of Ecosystem Science and Management. Students completing this option will not qualify for a subsequent Ph.D. program in Department of Ecosystem Science and Management at the University of Wyoming.

Master of Science in Entomology/Water Resources

Please refer to the Water Resources section of this Catalog for degree requirements.

Master of Science in Rangeland Ecology and Watershed Management

Plan A (thesis)

The master of science degree normally is offered under Plan A which requires at least the university minimum degree requirements and an oral examination.

An oral defense of the thesis is required.

Plan B (non-thesis)

Plan B is available under special circumstances and requires 30 hours of graduate coursework.

Plan B candidates must also prepare one professional paper (i.e., content and form compatible with publication in a scientific journal) or, if the adviser requests, two professional papers in selected topic areas.

An oral defense of the paper(s) is required.

Master of Science in Rangeland Ecology and Watershed Management/Water Resources

Please refer to Water Resources section of this Catalog for degree requirements.

Master of Science in Soil Science

Plan A (thesis)

Plan A requires the university minimum degree requirements and an oral final examination.

Plan B (non-thesis)

Plan B is available and requires 30 hours of graduate coursework.

An oral defense of the paper(s) is required.

Master of Science in Soil Science/Water Resources

Please refer to the Water Resources section of this Catalog for degree requirements.

Doctoral Programs

Doctor of Philosophy in Entomology

Candidates must complete the minimum requirements for the doctor of philosophy degree, plus a preliminary examination (written and oral) covering knowledge related to the discipline (taken after most coursework complete) and an oral final examination.

Doctor of Philosophy Program in Hydrology

Water Resources/Environmental Science and Engineering (WRESE) is an Interdisciplinary Ph.D. program that fulfills an important need by organizing a rigorous Ph.D.-level curriculum, with sufficient numbers of relevant, frequently-offered courses to serve the needs of Ph.D. students affiliated with program faculty.

The program's Ph.D.-level coursework is essential and forward-looking in areas such as aquatic chemistry, transport in natural systems, hydrometeorology, land-atmosphere interactions, eco-hydrology, hydrogeology, vadose zone hydrology, hydrologic applications of stable isotopes, limnology, hydrologic modeling, hydrological and water quality effects on aquatic organisms, hydroclimatology, hydrologic remote sensing and watershed hydrology.

Doctor of Philosophy in Rangeland Ecology and Watershed Management

Candidates must complete the minimum requirements for the doctor of philosophy degree, plus a preliminary examination (written and oral) covering knowledge related to the discipline (taken after most coursework complete) and an oral final examination.

Doctor of Philosophy in Soil Science

Candidates must complete the minimum requirements for the doctor of philosophy degree, plus a preliminary examination (written and oral) covering knowledge related to the discipline (taken after most coursework complete) and an oral final examination.

Doctor of Philosophy in Ecosystem Science and Management/Applied Economics

The course requirements for the PhD program in Ecosystem Science and Management (ESM) with a concentration in Applied Economics are highly flexible to accommodate a wide variety of student backgrounds and interests. Students can major in any PhD program within ESM including Rangeland Ecology and Watershed Management (REWM), Soil Science (SOIL), and Entomology (ENTO) following the ESM admission procedures. The student's graduate committee, with the approval of the Department Heads and College Dean, determine the final program of study. Acknowledging flexibility, each student's program of study is expected to meet the following minimum requirements:

A minimum of 72 credit hours of coursework. The credit hour requirement can include:

Up to 48 credit hours transferred from approved graduate courses earned while pursuing an M.S. degree (no more than 4 credit hours of thesis);

A minimum of 12 credit hours of approved ESM (REWM, SOIL, ENTO) courses;

A minimum of 18 credit hours of approved AGECE or ECON courses, with at least 12 credit hours at the 5000-level.

At least 42 of the 72 credit hour requirement must be earned in formal coursework.

No more than 12 credit hours of 4000-level courses can count towards the 72 credit hour requirement.

In addition to the degree requirements listed, students pursuing this option will also meet the following general requirements:

Enroll in, and complete, the graduate minor in Applied Economics.

Include co-chairs, one from ESM and one from AGECE, on the graduate committee.

Participate in a meaningful teaching experience to be coordinated by the student's major professor.

Complete a preliminary examination covering knowledge related to both ESM and AGECE.

Present research results at a formal public seminar.

Complete a final oral examination covering the student's thesis research administered by the graduate committee.

Graduate Certificate Program

Reclamation/Restoration Ecology Graduate Certificate

The Reclamation/Restoration Ecology (RRE) graduate certificate prepares the student to use basic and applied ecological concepts to reclaim and/or restore processes and functions to disturbed ecosystems. Reclamation and/or restoration of disturbed ecosystems requires an understanding of the edaphic, biotic, hydrologic, geologic, and topographic factors comprising these ecosystems, including the complex interrelationships that support and perpetuate ecosystem function. The graduate certificate will be granted to students who have completed a B.S. in an appropriate science-oriented discipline or are currently enrolled in an M.S. or Ph.D. program.

The graduate certificate will also be available to professionals working in reclamation/restoration oriented fields seeking to upgrade their training in reclamation and restoration ecology. Those interested in the graduate cer-

tificate will be required to complete the course work listed below as well as write a synopsis paper with a formal presentation advertised as an open forum seminar.

Required Certificate Courses:

Reclamation and restoration ecology courses
REWM 4200, REWM 5580 6 hours
Reclamation problems

SOIL 5565 or REWM 5640..... 4 hours

Reclamation process course (choose one)

BOT 5700, BOT 5730, BOT 5780, PLNT

5070, PLNT 5470, GEOL 5444, GEOL

5570, REWM 5280, REWM 5710, RNEW

5540, SOIL 5100, SOIL/MATH 5110,

SOIL 5120, SOIL 5130, SOIL 5140, SOIL

5150, ZOO 5550 3 hours

Planning/policy courses (choose one)

ENR 4900, ENR 5900 3 hours

Minimum total credits needed: 16 hours

Courses of instruction in the department are offered in agroecology, entomology, rangeland ecology and watershed management, renewable resources, and soil science.

Ecosystem Science and Management (ESM)

4990. Topics. 1-4 (Max 8). Topics pertaining to ecosystem science and natural resource management. Intended to accommodate instruction in various specialized subjects being offered for the first time or not offered on a regular basis. Students may enroll in more than one section of this course provided topics are different. *Prerequisites:* Appropriate to the particular topic will be specified in the course advertisement.

5995. Topics. 1-4 (Max 8). Topics pertaining to ecosystem science and natural resource management. Intended to accommodate instruction in various specialized subjects being offered for the first time or not offered on a regular basis. Students may enroll in more than one section of this course provided topics are different. *Prerequisites:* Appropriate to the particular topic will be specified in the course advertisement.

Renewable Resources (RNEW)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB4Q]).

2100 [BOT 2100]. Forest Management. 3. Principles of forest management. Topics include the laws affecting forest management, methods of harvesting wood from forests, fire and insect management, the effects of distur-

bances on stream flow and nutrient cycling, and the challenges of developing management plans for forests. Cross listed with ENR 2100. *Prerequisites:* LIFE 1001 or 1010.

2345. Natural Resource Ethics. 3. [CH,D4(none)] Introduction to ethics in context of natural resource extraction, use, conservation, preservation, and distribution. Ethical frameworks include teleological and deontological theories primarily applied to human needs and wants. Concepts and applications of environmental justice are addressed, including private property, sustainability, and obligations to future generations. Cross listed with ENR/PHIL 2340.

3000. Tropical Ecology. 3. Examines the characteristics of tropical ecosystems, how they evolved, their value to humans, their present status, and current issues relating to biodiversity, deforestation, extinction, and conservation. *Prerequisites:* LIFE 1001 or 1010.

4130. Applied Remote Sensing for Agricultural Management. 3. Addresses principles and applications of remote sensing to crop and rangeland management. Provides an overview of remote sensing concepts and applications pertaining to crops, shrubs and range vegetation. In laboratory, students will learn to process remotely sensed data for mapping and monitoring crop and rangelands. Cross listed with AECL/BOT 4130; dual listed with RNEW 5130. *Prerequisites:* QA course and 9 credit hours in student's major field and junior/senior standing or permission of instructor.

4340. Issues: Environmental Ethics. 3. Encompasses selected topics in environmental and natural resource ethics. Cross listed with PHIL 4340. *Prerequisites:* PHIL 2330, 3300, 3350.

4400. Invasive Plant Ecology. 3. Ecological impacts of invasive, non-indigenous plant species, the ecological, genetic and evolutionary hypotheses for invasiveness, as well as management strategies for invasive plant species. Dual listed with RNEW 5400; cross listed with AECL 4400. *Prerequisite:* LIFE 3400.

4730. Plant Physiological Ecology. 4. Acquaints advanced students with environmental factors which affect the establishment and growth of plants. Emphasizes adaptive mechanisms. Dual listed with RNEW 5730. Cross listed with BOT 4730. *Prerequisites:* one course in physiology and one course in ecology. (Normally offered spring semester)

4775. 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 under-

standing forest disturbances and succession, and implications for impacts of management and sustainability are discussed throughout. Cross listed with BOT 4775. *Prerequisite:* LIFE 3400.

4990. Topics in: _____ 1-4 (Max. 8). Special topics pertaining to renewable natural resource management. Intended to accommodate instruction in various specialized subjects not offered on a regular basis. Students may enroll in more than one section of this course provided topics are different. Dual listed with RNEW 5990. *Prerequisite:* consent of the instructor to pursue study of the topic.

5130. Applied Remote Sensing for Agricultural Management. 3. Addresses principles and applications of remote sensing to crop and rangeland management. Provides an overview of remote sensing concepts and applications pertaining to crops, shrubs, and range vegetation. In laboratory, students will learn to process remotely sensed data for mapping and monitoring crop and rangelands. Dual listed with RNEW 4130; cross listed with BOT 5130. *Prerequisites:* QA and 9 hours in student's major field and junior/senior standing.

5200. Spatial Analysis of Watersheds and Ecosystems. 3. Covers topics related to analysis of spatial and temporal processes at watershed and ecosystem scales using Geographic Information Systems (GIS). Topics include land classification and suitability analysis interpolation techniques, terrain analysis, model integration, and visualization. Sources of potential error and ramifications are examined. *Prerequisite:* GEOG 4210 or equivalent.

5400. Invasive Plant Ecology. 3. Ecological impacts of invasive, non-indigenous plant species, the ecological, genetic and evolutionary hypotheses for invasiveness as well as management strategies for invasive plant species. Dual listed with RNEW 4400; cross listed with AECL 5400. *Prerequisite:* LIFE 3400.

5500. Stable Isotope Ecology. 3. Application of stable isotope measurements to organismal and systems ecology. Lectures address the theory underlying the use of stable isotopes at natural abundance levels as tracers and integrators of important physiological and ecological processes. Laboratory exercises provide hands on experience with stable isotope ratio measurements. *Prerequisite:* graduate classification in a natural science or agriculture discipline.

5540. Shrubland Ecology. 3. Ecology of shrub-dominated lands and shrub species in grasslands. Location, importance and environmental constraints of shrub distributions. Topics include herbivory, woody plant invasions, competitive interactions, monitoring and

population dynamics. Emphasizes familiarity with scientific literature. *Prerequisite:* RNEW 3000, BOT 4700.

5545. Shrub Ecology Trip. 2. Field study in North American shrublands of western US ecosystems. Participants learn from researchers, managers, field activities, required readings and written assignments. Participants will be camping and a fee is required. *Prerequisite:* RNEW 5540.

5730. Plant Physiological Ecology. 4. Acquaints advanced students with environmental factors which affect the establishment and growth of plants. Emphasizes adaptive mechanisms. Lecture with inclusive hands-on laboratory. Dual listed with RNEW 4730; cross listed with BOT 4730/5730. *Prerequisite:* one course in physiology and 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. Dual listed with RNEW 4775; cross listed with BOT 5775 and ECOL 5775. *Prerequisite:* LIFE 3400.

5959. Enrichment Studies. 1-3 (Max. 3). Designed to provide an enrichment experience in a variety of topics. Note: credit in this course may not be included in a graduate program of study for degree purposes.

5985. Seminar. 1-3 (Max. 3). Current issues relevant to renewable resources research and management. Offered S/U only. *Prerequisite:* graduate standing.

5990. Topics In Renewable Resources. 1-4 (Max. 8). Special topics pertaining to renewable natural resource management. Intended to accommodate instruction in various specialized subjects not offered on a regular basis. Students may enroll in more than one section of this course provided topics are different. Dual listed with RNEW 4990.

Environment and Natural Resources Affiliate Degrees

Bachelor of Science degrees in either the Agroecology or the Rangeland Ecology and Watershed Management offered through the Ecosystem Science and Management Department may also be obtained as affiliate degrees with the School of Environment and Natural Resources (i.e., the degree titles would be Environment and Natural Resources/Rangeland Ecology and Watershed Management or Envi-

ronment and Natural Resources/Agroecology). The additional coursework requirements necessary for obtaining an affiliate degree are described in the School of Environment and Natural Resources section of this publication.

Entomology Minors Programs

Because of the pervasiveness of insects, the entomology minors programs provide a vital link among the life and environmental sciences at the University of Wyoming. Students will be prepared to serve society not just through the vital industry of agriculture, but through contributions to basic biology, human and animal health, ecosystem management, wildlife conservation and a myriad of other ways.

Minor in Insect Biology

This minor is intended for students who have an interest in insects as organisms, including their basic biology, ecology and evolution. As insects dominate biological diversity, they are essential to most ecological systems, and have unique physiological systems. Students majoring in zoology, botany, molecular biology, biology or similar fields will find the study of these organisms a rewarding and valuable (if not essential) element of the life sciences.

In terms of biological diversity, at least 75 percent of all species are insects, with over 800,000 known species and another 10-50 million yet to be described. Insects are increasingly used as bioindicators of environmental health. Many industries now recognize that insects may be the world's richest, untapped natural resource, with billions of dollars of unexploited goods and services. Accessing these resources requires trained entomologists. Such training demands an academic setting, such as the University of Wyoming, where collections are maintained, productive faculty are involved in quality research and teaching, the latest methodologies are available and taught, the necessary scientific literature is readily accessible and a curriculum available that allows the student to pursue this field.

Minimum requirements.....13

Choose one from ENTO 1000 or 1001,
then choose from ENTO 4678, 4682,
4684, 4686, 4687, and 4884 to meet the
minimum 13 credit hour requirement.

Insect Biology/Entomology Graduate Study

The department offers graduate work leading to the Master of Science and Doctor of Philosophy in entomology and an affiliated graduate option in water resources. Department faculty have active programs in insect

ecology (biological control, population biology and plant-insect interactions), systematics (taxonomy, phylogeny and evolution) and pest management (biological control, biometrics and sampling, and pest management on humans, livestock, crops and rangeland).

Entomology (ENTO)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1000. Insect Biology. 3. [SB♦PN] Introduces insects and related arthropods. Introduces aspects of insect biology, behavior, life history and diversity, as well as many ways that insects affect humans.

1001. Insect Biology. 4. [SB♦(none)] Covers same lecture material as ENTO 1000, but includes a laboratory.

1150. Pesticide Safety and Application. 1. Introduces various types and safe methods of pesticides application. Subsequent to completion, students may take the certification test administered by the Wyoming Department of Agriculture. Cross listed with CROP 1150. Offered S/U only. (Normally offered the week prior to spring semester)

4100. Senior Thesis: Proposal Preparation. 1-3 (Max. 6). Individualized preparation of a research proposal for a senior thesis project. Offered S/U only. *Prerequisite:* senior standing.

4200. Senior Thesis: Research Project. 1-3 (Max. 6). Individualized research project based on the senior thesis proposal. Offered S/U only. *Prerequisite:* ENTO 4100.

4300. Applied Insect Ecology. 3. Examines concepts of insect ecology and their application to the management of agricultural and rangeland insect pests. Control of rangeland weeds using insects is also examined. Covers population dynamics, predator-prey and insect-plant interactions, biological control and integrated pest management. *Prerequisite:* ENTO 1000 or 9 hours of biology or ecology-related coursework.

4678. Aquatic Entomology. 3. Emphasizes biology, ecology, distribution, and taxonomy of aquatic insects. Includes aquatic insects as indicators of pollution. Students must make and identify a collection of immature aquatic insects. Dual listed with ENTO 5678. *Prerequisite:* ENTO 1000, 1001. (Normally offered fall semester of even-numbered years)

4682. Insect Anatomy and Physiology. 5. Studies structure and function of the insect body, particularly emphasizing the relationship between anatomical features and their cellular/biochemical functions. Dual listed

with ENTO 5682. *Prerequisite:* ENTO 1000. (Normally offered spring semester of even-numbered years)

4684. Classification of Insects. 4. Studies insect orders, families and taxonomic treatises. Requires collection of adult insects representing 100 families, or equivalent museum project, for completion of course requirements. Dual listed with ENTO 5684. *Prerequisite:* ENTO 1000. (Normally offered fall semester of odd-numbered years)

4686. Problems in Entomology. 1-3 (Max. 6). Individual library, laboratory or field study of insects. *Prerequisites:* 4 hours of biological science and 3 hours of entomology. (Offered fall, spring and summer semesters)

4687. Insect Evolution. 3. Examines major events of insect evolution including origins, fossils, wings and flight, metamorphosis, extinct orders, diversification patterns of modern orders, climate change, plate tectonics, coevolution with plants, parasitism, social behavior, and origin of modern faunas. Dual listed with ENTO 5687. *Prerequisite:* ENTO 4684 required; ENTO 4670, 4682 recommended.

4852. Senior/Graduate Seminar. 1 (Max. toward B.S. 2; Max. toward M.S. 2; Max. toward Ph.D. 6). Presentation of results and interpretation of the senior thesis research. Dual listed with ENTO 5852.

4884. Insect Behavior. 3. Examines the behavior of insects, including foraging, mating and social behavior. The course focuses on the applied as well as the fundamental aspects of behaviors, and both the strategic and physiological bases of behavior. Dual listed with ENTO 5884. *Prerequisite:* ENTO 1000.

5080. Statistical Methods for the Agricultural and Natural Resource Sciences. 3. Brief review of statistical principles. Use of SAS programming. Numerous analysis of variance techniques along with commonly used experimental designs. Multiple mean comparisons, linear contrasts, power of F test, simple linear regression, polynomial regression, analysis of covariance, and some categorical data techniques for student in the agriculture and natural resources sciences. Credit cannot be earned in more than one of the following courses: STAT 2100, 3050, 5050, 5060, 5070, 5080. Cross listed with STAT 5080. *Prerequisite:* STAT 2050 or equivalent.

5300. Applied Insect Ecology. 3. Examines concepts of insect ecology and their application to the management of agricultural and rangeland insect pests. Control of rangeland weeds using insects is also examined. Covers population dynamics, predator-prey and insect-plant interactions, biological control and integrated

pest management. Dual listed with ENTO 4300. *Prerequisite:* ENTO 1000 or 9 hours of biology or ecology related coursework.

5601. Insects for Teachers: Collection and Identification of Insects. 1. Designed for school teachers K-12. Basic concepts such as insect classification, insect habitats, insect metamorphosis, and destructive and beneficial insects are discussed with emphasis on the presentation of these concepts in the school classroom. Half of the class is devoted to field trips, laboratories, workshop activities, and films. Each student will make an insect collection, and learn how to preserve, mount, and identify specimens to order level. Course may be taken independently of ENTO 5602. Identical to NASC 4790. *Prerequisite:* junior standing. Offered summer term only.

5602. Insects in the Classroom: Insects and Their Ways. 1. Designed for school teachers K-12. Basic concepts of insect structure and function (insect morphology, insect physiology, insect ecology, and insect behavior) are discussed with emphasis on the presentation of these concepts using living insects in the classroom. Half of the class is devoted to field trips, laboratories, workshop activities, and films. Each student will design, conduct, and write-up an experiment with insects. Course may be taken independently of ENTO 5601. Identical to NASC 4790. *Prerequisite:* junior standing. Offered summer term.

5678. Aquatic Entomology. 3. Biology, ecology, distribution and taxonomy of aquatic insects will be emphasized. Additional material covered will include aquatic insects as indicators of pollution. Students must make and identify a collection of immature aquatic insects. Dual listed with ENTO 4678. *Prerequisite:* 1 year of basic biology.

5682. Insect Physiology. 5. Structure and function of the insect body, with particular emphasis on the relationship between anatomical features and their cellular/biochemical functions. Dual listed with ENTO 4682. *Prerequisite:* ENTO 1000.

5684. Classification of Insects. 4. A study of insect orders, families and taxonomic treatises. Collection of adult insects representing 100 families, or equivalent museum project, is required for completion of course requirements. Dual listed with ENTO 4684. *Prerequisite:* ENTO 1000; ENTO 4670 is recommended.

5686. Problems in Entomology. 1-3 (Max. 6). Individual library, laboratory or field study of insects. Dual listed with ENTO 4686. *Prerequisite:* 4 hours of biological science and 3 hours of entomology.

5687. Insect Evolution. 3. Examines major events of insect evolution including origins, fossils, wings and flight, metamorphosis, extinct orders, diversification patterns of modern orders, climate change, plate tectonics, coevolution with plants, parasitism, social behavior, and origin of modern faunas. Dual listed with ENTO 4687. *Prerequisite:* ENTO 4684/5684 required. Recommended: ENTO 4670/5670, ENTO 4682/5682.

5689. Topics in Entomology. 1-4 (Max. 6). Current topics in entomology taught by entomology faculty, adjunct faculty or visiting faculty. Please check class schedule for current title.

5850. Research in Entomology. 1-3 (Max. 8). Individual investigations of particular problems. *Prerequisite:* graduate standing

5852. Senior/Graduate Seminar. 1 (Max. 6). Discussion of important contributions to entomology. Dual listed with ENTO 4852. *Prerequisite:* graduate standing.

5884. Insect Behavior. 3. Fundamentals of insect behavior and an analysis of behavioral patterns. Dual listed with ENTO 4884. *Prerequisite:* one year of basic biology or equivalent; ENTO 5682 is recommended.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate status.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1-12 (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. 1-12 (Max. 48). Graduate level course 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. *Prerequisites:* enrollment in a graduate level degree program.

Agroecology Program

Rooms 50/2013 Agriculture Building
(307) 766-3103/766-2263

Departments of Plant Sciences and
Ecosystem Science and Management

The Bachelor of Science degree program in agroecology is an interdepartmental major involving the collaborative teaching, advising and research expertise in the Departments of Plant Sciences and Ecosystem Science and Management. An agroecology minor is also available. See the Plant Sciences section under the College of Agriculture and Natural Resources for more information on the Agroecology program.

Rangeland Ecology and Watershed Management Major

Rangeland occupies 47% of the Earth's land area. The 50 million acres of rangeland in Wyoming provide diverse opportunities for the multiple uses of livestock and wildlife grazing, recreation, water production and natural beauty. Students are taught to understand and manage complex rangeland ecosystems.

The rangeland ecology and watershed management curriculum is designed for students choosing to study ecology, utilization and management of rangelands and wildland watersheds and related resources of forestry, recreation, wildlife management, soil science, botany, and zoology. Degrees include Bachelor of Science, Master of Science, and Doctor of Philosophy.

The undergraduate course of study helps students become well prepared for careers in natural resource management (e.g., range management, watershed management, restoration ecology/reclamation of degraded land, wildlife habitat management, ranch management, various types of environmental consulting), or other natural science careers. The curriculum fully meets the Office of Personnel Management (OPM) requirements for Range Conservationist. By appropriate course selection within the elective hours, students will also meet OPM requirements for additional professional work, such as soil conservationist or hydrologist.

Rangeland Ecology and Watershed Management Graduate Study

Areas of graduate study leading to a M.S. or Ph.D. in rangeland ecology and watershed management include range ecology, animal nutrition, watershed management, wildlife habitat management, restoration ecology, and reclamation of disturbed lands. A graduate certificate in reclamation and restoration ecology and a graduate option in water resources are offered in affiliation with the rangeland ecology and watershed management graduate degree.

Course Requirements for a Major in Rangeland Ecology and Watershed Management (B.S.)

	Hrs.
REWM	37
2000*, 2400*, 3000*, 3020*, 3100*, 4285*, 4330*, 4530*, 4700*, 4830*, 4850*, 4900*	
Resource management.....	14-15
SOIL 2010*, SOIL 4120*, AGEC 4700*, and choose one from RNEW 4130*, BOT 4111*, BOT 3150* or GEOG 4200*	
Physical and Natural World	8
LIFE 1010 and CHEM 1000	
Biological sciences	7
LIFE 2022* or 2023*, LIFE 3400*	
Communication skills.....	6
USP Communication 1 and COJO 2010	
Quantitative reasoning	7
MATH 1400, STAT 2050	
Human Culture	6
Human Culture, ECON 1020	
First-Year Seminar	3
US and WY Government.....	3
Electives	28-29
Total	120

*Course must be completed with a C or better.

Minor

A minor in rangeland ecology and watershed management is available for students in other majors interested in increasing their knowledge of the field. The number of hours required is 22. The required courses for the minor are: LIFE 1010 (4 hrs.) and 3400 (3); and REWM 2000 (3), 2500 (2), 4330 (3), 4530 (1) and 6 hrs. selected from other REWM upper-division (3000 or 4000 level) courses.

Rangeland Ecology and Watershed Management (REWM)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

2000. Principles of Rangeland Management. 3. Basic principles of range management as they apply to various regions and vegetative types. Relationship of range management practices to livestock production, wildlife management, forestry, hydrology and other land uses. Introductory course for majors and non-majors. *Prerequisite:* LIFE 1001 or 1010.

2400 [2500]. Range Ecosystems and Plants. 4. Ecology of range ecosystems of western North America and identification of 200 most common plants species, including taxonomic keying. *Prerequisite:* REWM 2000 with a grade of C or better.

3000. Plant Ecophysiology/Plant Form and Function. 4. Integration of basic vascular plant anatomy, morphology, physiology within the contexts of modern evolutionary and ecological theory. Students receive in depth exposure to fluid flow, energetics, development, growth, general metabolism, and structure, and functions for plant cells, tissue and organs. *Prerequisite:* LIFE 2022 or LIFE 2023.

3020. Nutritional Management of Grazing Ungulates. 4. Characterization of grazing animal nutritional needs and foraging behavior; rangeland forages and supplements. Management of animals and forages/feeds to optimize nutrient intake. *Prerequisite:* approved University Studies biological sciences course. (Normally offered fall semester)

3100. Principles of Wildland Water Quality. 3. Basic principles of aquatic chemistry and water quality as they relate to watershed management practices including livestock production, agronomic production, mineral and natural gas extraction and other land uses. Cross listed with ENR 3100. *Prerequisite:* CHEM 1000. (Normally offered fall semester)

3390. Range Judging. 2. Judging rangelands based on soil, plant and animal resources and applying science-based information to make management decisions. Participation in a field trip and UW SRM judging teams is required including Plant Team and URME. This course is intended for members of the SRM competitive Teams. *Prerequisites:* C or better in REWM 2000, REWM 2400 and REWM 3020, as well as the Team Coach permission. (Normally offered spring semester)

3500. Rangeland Plant Ecophysiology.

3. Examines plant physiological processes that have application to ecological and land management issues. Topics include carbon assimilation, water relations, mineral nutrition as applied to plant distributions, plant and system responses to grazing, as well as plant tolerance of extreme conditions including drought, excessive temperatures and changes in climate. *Prerequisite:* LIFE 2022 or 2023. (Normally offered fall semester)

4000. Poisonous Plants and Plant Toxins.

3. Plants poisonous to livestock in Wyoming and the Mountain West; identification, ecology, toxic principles, physiologic responses of animals, situations leading to poisoning, control and management to prevent losses. *Prerequisite:* 12 hours of biological and chemical sciences. (Normally offered spring semester)

4051. Environmental Politics. 3.

[WC♦(none)] Analyzes environmentalism as a political phenomenon. Provides students with a basic understanding of how to analyze political issues by: (1) examining the historical and contemporary issues that produce controversy over environmental matters; and (2) surveying the impacts of these issues on the formulation and implementation of laws, policies, and regulations. Cross listed with AMST, ENR, GEOG and POLS 4051. *Prerequisite:* POLS 1000.

4052. Federal Land Politics. 3. Examines the political forces that have shaped and continue to shape federal land policy and management. Explores the interactions between democratic decision making and science in the management of federal lands. Surveys the sources of controversy over federal land management and methods for harmonizing public demands with technical expertise. Cross listed with POLS/ENR/GEOG/AMST 4052. *Prerequisite:* POLS 1000.

4103 [3103]. Range and Ranch Recreation.

3. Understanding of public demands for leisure use of public and private rangelands; potential impacts on rangeland resources, ranch practices and families and other rangeland users. Students prepare public range or private ranch recreation operations plan. Graduate students assist in preparation and presentation of lecture. Dual listed with REWM 5103. *Prerequisites:* C or better in REWM 2000 and CS course. (Normally offered spring semester)

4150 [3150]. Behavior Modification for Production of Grazing Herbivores. 3.

Strategies for manipulation of behavior and management of the grazing herbivore will be developed from scientific and practical information. Designed to equip the student to manage for animal and natural resource

production. Dual listed with REWM 5150. *Prerequisites:* C or better in REWM 2000 and REWM 3020 or ANSC 3100. (Normally offered spring semester)

4200. Reclamation of Drastically Disturbed Lands. 3.

Overviews reclamation of drastically disturbed lands in the west, emphasizing surface mined lands. Includes principles of ecology, agronomy, soils and other relevant disciplines as applied to mitigate adverse environmental impacts of land disturbance. *Prerequisite:* LIFE 3400, AECL 2100. (Normally offered fall semester)

4210. Land Reclamation Seminar. 1 (Max. 2).

Discusses pertinent topics within the reclamation field of disturbed lands. *Prerequisite:* REWM 4200 or concurrent registration. (Normally offered fall semester)

4285. Wildland Hydrology. 3. Teaches essential and unique characteristics of hydrologic cycle as occurred on range and forest lands, concentrating on quantification of these processes and storages. Cross listed with ENR 4285. Dual listed with REWM 5285. *Prerequisite:* QA (Normally offered fall semester of even-numbered years)

4300 [3320]. Grass Taxonomy. 3. Identification of grasses and their place in range management and world agriculture. Dual listed with REWM 5300. *Prerequisite:* REWM 2500 or LIFE 2023. (Normally offered spring semester)

4330. Rangeland Ecosystem Assessment and Monitoring. 3.

Assessment, monitoring, and analysis of rangeland ecosystems and processes. Students integrate sampling design, measurements of vegetation attributes, indicators of rangeland health, ecological site information, riparian and wildlife habitat values, utilization, and statistical applications to evaluate rangeland resource integrity and sustainable use. Students collect, analyze, and report data using current technologies. *Prerequisites:* REWM 2000, REWM 2500, and STAT 2050 or 2070. Concurrent enrollment in REWM 2500 and STAT 2050/STAT 2070 is permissible. (Normally offered fall semester)

4340. Reclamation Techniques Field Trip.

2. Provides increased comprehension of current land reclamation problems and solutions by means of a field trip to sites in region where land reclamation is occurring. *Prerequisite:* REWM 4200. (Normally offered fall semester)

4530. Seminar. 1 (Max. 2). Discusses pertinent range management problems. *Prerequisite:* REWM 2000 (earn at least a C) or ENR 4000.

4540. Problems. 1-4 (Max. 6). Experimental work or intensive reading and discussion on range management problems. Includes problems offered in the following areas of range

management: natural resources ecology, livestock habitat, business, improvements, watershed, reclamation, extension, and international development. *Prerequisite:* basic training in field of problem selected and consent of instructor. (Offered fall, spring and summer)

4550. Internship in _____. 1 (Max. 4).

Supervised field experience in range management or disturbed land reclamation. No more than 4 credits. *Prerequisites:* basic course work in subject selected and consent of instructor.

4580. Rangeland Restoration Ecology. 3.

Detailed analysis of various disturbed ecosystems unique to western rangelands. Primary emphasis on plant community restoration following degradation from edaphic, biotic, hydrologic, and topographic influences on degradation and strategies for vegetative rehabilitation. Strong focus on current research to formulate restoration strategies. Dual listed with REWM 5580. *Prerequisites:* REWM 4200 or LIFE 3400.

4700. Wildland Watershed Management.

3. Studies hydrological cycle with specific emphasis on the role of vegetation in hydrologic processes such as interception, surface detention storage, infiltration, percolation, run-off, and water quality. Utilization of watersheds and vegetation manipulation practices to modify these hydrologic processes. *Prerequisite:* LIFE 1001 or 1010. (Normally offered spring semester)

4710 [4180]. Watershed Water Quality Management. 3.

Studies watershed processes controlling water quality. Examines impacts of land use activities such as agriculture production, livestock grazing, and mineral and natural gas extraction on surface water and ground water quality. Emphasis will be placed on water quality modeling and management. Dual listed with REWM 5710. *Prerequisites:* CHEM 1000. (Normally offered spring semester)

4750. Wildlife Habitat Restoration Ecology. 3.

Emphasis on fundamental and applied aspects of restoration ecology for terrestrial wildlife habitats following anthropogenic and natural disturbances. Although the course overviews theoretical concepts applicable to many systems, there is a focus on applications for wildlife habitats in western North America. Dual listed with REWM 5750. *Prerequisites:* Minimum of 6 hours of Biology or Life Sciences courses.

4830. Ecological Applications for Wildland Management. 3. [WB♦(none)]

Emphasis on applying understanding of interactions among components of rangelands to facilitate sustainable provision of ecosystem services. The influences of stochasticity and disturbances

on ecosystem structure and function will be the focus of discussion and technical writing exercises. *Prerequisites:* WA, REWM 2000 (earn at least a C), LIFE 3400 (latter may be concurrent). (Normally offered fall semester)

4850. Rangeland Vegetation Management Techniques. 3.

Uses applied ecological principles in restoration of degraded rangeland ecosystems to introduce methods for manipulating rangeland vegetation that satisfy land management objectives. Provides ecologically-sound practices to maintain optimal and sustained yield of rangeland products. *Prerequisites:* C or better in REWM 2000 and SB. (Normally offered spring semester)

4900. Rangeland Management Planning.

3. [WC♦COM3] Applies planning processes that integrate soil, vegetation, water, livestock, wildlife, and environmental regulatory considerations within the context of satisfying ecologically sustainable rangeland management objectives. *Prerequisites:* REWM 4830, ECON or AGE 1010 or 1020, SOIL 4120 or 4150 (may be concurrent), REWM 3020 (may be concurrent), REWM 4330 (may be concurrent). (Normally offered spring semester)

4990. Undergraduate Teaching Practicum.

1 (Max 2). Teaching experience in classroom or laboratory assisting faculty instructor. (Offered based on sufficient demand and resources)

5000. Range Resource Management. 3.

Basic concepts and theories of rangeland resource management, trends in rangeland classification, grazing management and improvement practices. *Prerequisite:* graduate classification in agriculture or related natural resource subject matter areas.

5050. Range Forage Quality. 3.

Effects of environments, grazing, and management factors on preference and forage values of native range plants for domestic and wild grazing animals. *Prerequisite:* graduate or senior standing and REWM 2000 and ANSC 2020 or 3100.

5103. Range and Ranch Recreation. 3.

Understanding of public demands for leisure use of and private rangelands; potential impacts on rangeland resources, ranch practices and families and other rangeland users. Preparation of public range or private ranch recreation operations plan. Graduate students assist in preparation and presentation of lecture. Dual listed with REWM 4103. *Prerequisites:* REWM 2000 and CS course.

5150. Behavior Modification for Production of Grazing Herbivores. 3.

Strategies for manipulation of behavior and management of the grazing herbivore are developed from scientific and practical information. Designed

to equip the student to manage for animal and natural resource production. Dual listed with REWM 4150. *Prerequisite:* REWM 2000 and ANSC/REWM 3020 or ANSC 3100.

5250. Water Resources Seminar. 1. Objective is to develop interaction among students from the various water resource disciplines to enhance their perspectives on how water problems are addressed within an interdisciplinary environment. *Prerequisite:* graduate status.

5285. Wildland Hydrology. 3.

Teaches essential and unique characteristics of hydrologic cycle as occurs on range and forest lands, concentrating on quantification of these processes and storages. Cross listed with ENR 5285. Dual listed with REWM 4285. *Prerequisite:* graduate standing and University Studies QA.

5300. Grass Taxonomy. 3.

Identification of grasses and their place in range management and world agriculture. Dual listed with REWM 4300. *Prerequisite:* REWM 2500 or LIFE 2023.

5520. Ecology and Management of Grasslands. 3.

Ecological nature, management strategies, and management problems of North American and world grassland ecosystems. *Prerequisites:* REWM 4300, 5300 and BOT 4700.

5580. Rangeland Restoration Ecology. 3.

Detailed analysis of various ecosystems unique to western rangelands. Primary emphasis on plant community restoration following degradation from edaphic, biotic, hydrologic, and topographic factors. Application of ecological principles to rehabilitate vegetation and restore ecosystem function. Strong emphasis on current research to formulate restoration strategies. *Prerequisites:* REWM 4200 or LIFE 3400.

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 ECOL 5610. *Prerequisites:* upper division stats course (e.g., STAT 4015 or STAT 4025) and graduate standing.

5620. Graduate Seminar. 1-2 (Max. 6).

Presentation and discussion of recent range management research. *Prerequisite:* graduate standing.

5640. Investigation. 1-4 (Max. 10).

Research on specialized problems in range management. Investigations offered in the following areas of range management, habitat management, business management, range improvements and

monitoring, watershed management, extension and international development. *Prerequisite:* graduate standing.

5710. Watershed Water Quality Management. 3. Studies watershed processes controlling water quality. Examines impacts of land use activities such as agriculture production, livestock grazing and mineral and natural gas extraction on surface water and ground water quality. Emphasis is placed on water quality modeling and management. Dual listed with REWM 4710. *Prerequisites:* CHEM 1000.

5750. Wildlife Habitat Restoration Ecology. 3. Emphasis on fundamental and applied aspects of restoration for terrestrial wildlife habitats following anthropogenic and natural disturbances. Although the course overviews theoretical concepts applicable to many systems, there is a focus on applications for wildlife habitats in western North America. Dual listed with REWM 4750. *Prerequisites:* Minimum of 6 hours of Biology or Life Sciences courses.

5800. Experiments in Restoration. 2. Emphasis on the current status of restoration science and the application of ecological theory in restoration ecology. Focus on concepts of population genetics, metapopulation biology and ecosystem science, food webs, biodiversity and invasion, conceptual models, experimental design, and climate change. Address topics in experimental, ecological restoration. *Prerequisites:* graduate standing, STAT 2050, LIFE 3400.

5830. Wildlife Habitat Ecology. 2. For students in wildlife and rangeland ecology emphasizing the relationships between wildlife populations and their habitats. Concepts forming the basis of wildlife habitat ecology including habitat and niche, habitat metrics, resource selection, habitat-relationships modeling, and habitat restoration and management. *Prerequisites:* Graduate-level course in statistics and graduate standing or instructor consent.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate status.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5960. Thesis Research. 1-12 (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. 1-12 (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.

Earth System Science with a Concentration in Soil Science

The new Earth's Systems Science (ESS) undergraduate program integrates several disciplines across the UW campus, providing greater opportunities for students to learn about the importance of different components of the Earth. Soil Science is an integrating subject that unifies interactions among the atmosphere, hydrosphere, lithosphere, and biosphere. An ESS degree with a concentration in Soil Science enhances educational opportunities for students by offering unique learning experiences because of UW's location, resources, and faculty.

FRESHMAN YEAR: Fall		Hrs.
MATH	1400	3
CHEM	1000	4
First-Year Seminar		3
Communication I (COM 1)		3
ECON	1020	3
Total		16

FRESHMAN YEAR: Spring		Hrs.
LIFE	1010	4
REWM	2000	3
Human Culture (H)		3
US & WY Constitutions (V)		3
Electives		3
Total		16

SOPHOMORE YEAR: Fall		Hrs.
LIFE	2023	4
REWM	2400	4
Electives		6
Total		14

SOPHOMORE YEAR: Spring		Hrs.
LIFE	3400	3
SOIL	2010	4
STAT	2050	4
Electives		3
Total		14

JUNIOR YEAR: Fall		Hrs.
REWM	3020	4
REWM	4330	3
SOIL	4120	4
REWM	3100	3
Total		14

JUNIOR YEAR: Spring		Hrs.
REWM	4700	3
REWM	4850	3
REWM	3000	4
Electives		6
Total		16

SENIOR YEAR: Fall		Hrs.
REWM	4530	1
REWM	4830	3
REWM	4285	3
RNEW	4130	3
Electives		6
Total		16

SENIOR YEAR: Spring		Hrs.
REWM	4900	3
AGEC	4700	3
Electives		8
Total		14

Total Credit Hours 120

Minor in Soil Science

This program is designed to enhance soil expertise for students majoring in agricultural, natural resources, and environmental sciences degree programs. Undergraduate students minoring in Soil Science will enhance their job prospects with federal land management or conservation agencies (e.g., Forest Service, Bureau of Land Management, Natural Resources Conservation Society), state and federal regulatory agencies (e.g., Wyoming Department of Environmental Quality), mining and oil companies, environmental consulting companies, or scientific research organizations.

Course requirements (15 credit hours) for a Soil Science minor are: SOIL 2010, plus 11 credits of upper-division soil science courses for a total of 15 credits.

Soil Science Graduate Study

The department offers graduate work leading to the Master of Science and Doctor of Philosophy degrees in soil science, an affiliated graduate certificate in reclamation and restoration ecology, and an affiliated graduate option in water resources. Our faculty have active programs in soil-plant fertility and nutrition, soil morphology, genesis and classification, soil and water quality, environmental soil microbiology, soil and environmental chemistry, and soil and water physics.

Soil Science (SOIL)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB4Q]).

2010. Introduction to Soil Science. 4. [SE4(none)] Introduces soil ecological processes and management in terrestrial environments. Discusses interaction of soil, biological, chemical, morphological, and physical properties with land management in wild land and agricultural ecosystems. Emphasis is on plant response to soil conditions. *Prerequisites:* CHEM 1000 or CHEM 1020.

3000. Irrigated Agriculture. 3. Study of the complexity of plant/soil water relationships and its importance on irrigation. Soil and water relations, reference/crops evapotranspiration, and management of the water balance. Principles of chemigation, computer modeling/monitoring included. Methods for irrigation scheduling and the importance of water use efficiency as a strategy for water conservation. Cross listed with PLNT 3000. *Prerequisites:* MATH 1400, SOIL 2010.

3130. Environmental Quality. 3. Introduction to environmental quality issues and events. Course emphasizes impacts to soil, water, atmospheric, and vegetative ecosystems due to different nutrients and contaminants, including nitrogen, phosphorus, sulfur, trace elements, and organic chemicals. Current information pertaining to environmental quality is discussed and a field trip to the Union Pacific Tie Plant. Cross listed with ENR 3130. *Prerequisite:* complete at least 1 University Studies Science course SB, SP or SE. (Offered fall semester)

4100. Soil Physics. 3. Examines forms and interrelations of matter and energy in the soil environment. Primarily addresses fluxes and transformations of soil water and solutes, as well as physical properties that influence soil productivity. Dual listed with SOIL 5100. *Prerequisite:* SOIL 2010 or equivalent introductory soils course. (Offered spring semester)

4105. Soil Physics Laboratory. 2. Teaches students the methodology and use of equipment to measure soil physical properties in the laboratory and field. Experiments include particle size analysis, soil surface area, soil-water measurement with neutron probe and TDR, field infiltration rate, soil-water retention curve, soil pore size distribution saturated and unsaturated conductivities, soil water potential and solute breakthrough curve. Dual listed with SOIL 5105. *Prerequisite:* SOIL 2010.

4120. Genesis, Morphology and Classification of Soils. 4. Processes of soil development and methods of description, survey and classification. Includes field trips which examine soils in the Laramie Basin and surrounding mountains. Dual listed with SOIL 5120. *Prerequisite:* SOIL 2010. (Offered fall semester)

4130. Chemistry of the Soil Environment. 3. Introduction to the chemical properties and reactions that occur in the soil environment. Fundamental principles of soil mineralogy, organic matter and equilibrium chemistry as they relate to soil chemical reactions, plant nutrient availability and pedogenetic processes will be emphasized. Dual listed with SOIL 5130. *Prerequisite:* SOIL 2010, CHEM 1030 or CHEM 1060. (Offered spring semester)

4135. Soil Chemistry Laboratory. 2. Laboratory techniques and methods of analysis will be used to examine soils, sediments, and water chemical characteristics and reactions. Experiments will include data analysis, computer models, nutrient and contaminant characteristics, mineral properties, soil/sediment oxidation-reduction reactions as well as others. Students will be required to develop a soil chemistry experiment in their area of interest. Dual listed with SOIL 5135. *Prerequisite:* completion or concurrent enrollment in SOIL 4130/5130 or GEOL 4777.

4140. Soil Microbiology. 4. Fundamental principles of soil microbiology and how they relate to microbial ecology, environmental contamination, agriculture and forestry. Dual listed with SOIL 5140; cross listed with MICR 4140. *Prerequisite:* SOIL 2010.

4150. Forest and Range Soils. 3. Characteristics and management of forest and range soils primarily in arid environments. Examines pedagogical units representative of forests and ranges and soil properties, such as nutrient availability and water relations that influence plant growth. Dual listed with SOIL 5150. *Prerequisites:* SOIL 2010. (Normally offered fall semester)

4160. Soil Fertility and Fertilizers. 3. Physical, chemical, and biological aspects of soils that impact fertilizer fate, uptake, and plant growth. Dual listed with SOIL 5160. *Prerequisite:* SOIL 2010. (Normally offered fall semester of odd-numbered years)

4535. Soil Biogeochemistry. 3. Focuses on fundamental considerations of organic substances, microbiological systems, and chemical processes in soils, sediments, and waters. Examination of the nature and origin of organic matter and the role of microorganisms in organic nutrient transformations, reac-

tions, and interactions in different ecosystems. Dual listed with SOIL 5535. *Prerequisites:* SOIL 2010, completion of courses in introductory college chemistry and biology, and consent of instructor(s).

4565. Research: Soil Science. 1-4 (Max. 6). Library, laboratory, and/or green-house investigations on select research topics. Graduate students will be required to give a presentation to the soil science group on their final product/report. Dual listed with SOIL 5565. *Prerequisite:* basic training in soil science research.

5100. Soil Physics. 3. Examines the forms and interrelations of matter and energy in the soil environment. Fluxes and transformations of soil water and solutes are addressed primarily, as well as physical properties which influence soil productivity. Dual listed with SOIL 4100. *Prerequisite:* MATH 2310.

5105. Soil Physics Laboratory. 2. Students learn methodology and use of equipment to measure soil physical properties in the laboratory and field. Experiments include particle size analysis, soil surface area, soil-water measurement with neutron probe and TDR, field infiltration rate, soil-water retention curve, soil pore size distribution, saturated and unsaturated conductivity, soil water potential, and solute breakthrough curve. Dual listed with SOIL 4105. *Prerequisite:* SOIL 2010.

5110. Modeling Water and Chemical Transport in Vasoe Zone and Groundwater Systems. 4. Mathematical models will be formulated and applied to simulate water flow and chemical transport in soil and groundwater systems. Soil spatial variability and heterogeneity will be considered in the modeling processes. Using and comparing models, students will obtain the capability to transfer a physical problem to a mathematical model, to use numerical methods, such as the finite element method, to solve the mathematical problem, and to correctly interpret the numerical outputs. Students will develop and program numerical solutions for select problems and will utilize existing codes for modeling a variety of comprehensive problems. Cross listed with MATH 5110.

5120. Genesis, Morphology, and Classification of Soils. 4. Processes of soil development and methods of description, survey and classification. Includes field trips which examine soils in the Laramie Basin and surrounding mountains. Dual listed with SOIL 4120. *Prerequisite:* SOIL 2010.

5130. Chemistry of the Soil Environment. 3. Evaluation of the chemical and physical properties and reactions that occur in the soil

environment. Fundamental principles of soil mineralogy, organic matter, and equilibrium chemistry as they relate to soil chemical reactions, plant nutrient availability, and pedogenetic processes will be emphasized. Dual listed with SOIL 4130. *Prerequisite:* MATH 1400, CHEM 1030 or CHEM 1060 and SOIL 2010.

5135. Soil Chemistry Laboratory. 2. Laboratory techniques and methods of analysis are used to examine soils, sediments, and water chemical characteristics and reactions. Experiments include data analysis, computer models, nutrient and contaminant characteristics, mineral properties, soil/sediment oxidation-reduction reactions as well as others. Students are required to develop a soil chemistry experiment in their area of interest. Dual listed with SOIL 4135. *Prerequisite:* completion or concurrent enrollment in SOIL 4130/5130 or GEOL 4777/5777.

5140. Soil Microbiology. 4. Fundamental principles of soil microbiology and how they relate to microbial ecology, environmental contamination, agriculture, and forestry. Dual listed with SOIL 4140; cross listed with MICR 5140. *Prerequisite:* SOIL 2010

5150. Forest and Range Soils. 3. Characteristics and management of forest and range soils primarily in arid environments. Examines pedagogical units representative of forest and ranges and soil properties, such as nutrient availability and water relations, which influence plant growth. Dual listed with SOIL 4150. *Prerequisite:* SOIL 2010 and LIFE 2020.

5160. Soil Fertility and Fertilizers. 3. Physical, chemical and biological aspects of soils which impact fertilizer fate, uptake and plant growth. Dual listed with SOIL 4160. *Prerequisite:* SOIL 2010.

5430. Applied Geostatistics. 3. Designed to provide general geostatistical analyses and their applications for spatial random variables and functions. Topics covered include variogram, cross validation, kriging, cokriging, sampling strategies, and both non-conditional and conditional simulations. Several geostatistics packages are used to analyze real field data and students are encouraged to use their own data for practicing geostatistical applications. Examples are taken from geohydrology, soil science, crop science, mining, and various environmental studies. Cross listed with GEOL/STAT 5430. *Prerequisite:* STAT 4020.

5510. Advanced Soil Genesis and Classification. 3. In-depth evaluation of the science of pedology, the philosophy and implementation of soil classification in the U.S. and world, and the formation of soils in different environments. *Prerequisite:* SOIL 5120 and graduate standing.

5535. Soil Biogeochemistry. 3. Focuses on fundamental considerations of organic substances, microbiological systems, and chemical processes in soils, sediments, and waters. Examination of the nature and origin of organic matter and the role microorganisms in organic nutrient transformations, reactions, and interactions in different ecosystems. Dual listed with SOIL 4535. *Prerequisite:* SOIL 2010 and consent of instructor.

5565. Research in Soil Science. 1-4 (Max. 6). Library, laboratory, and/or greenhouse investigations on select research topics. Graduate students will be required to give a presentation to the soil science group on their final product/report. Dual listed with SOIL 4465. *Prerequisite:* Basic training in soil science research. SOIL 5565 reserved for graduate students.

5590. Special Topics in Soil Science. 1-3 (Max. 6). Special topics in soil science. Offered as an individual or small group basis as appropriate. Intended to accommodate various specialized subjects not offered on a regular basis. Students may enroll in more than one section of this course. Dual listed with SOIL 4590. *Prerequisite:* consent of instructor.

5720. Graduate Seminar. 1 (Max. 6). Review and discussion of recent soil research. *Prerequisite:* basic training in the field of problem selected and consent of instructor.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate standing.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1-12 (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. 1-12 (Max. 48). Graduate level course 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.

Department of Family and Consumer Sciences

251 Agriculture Building, (307) 766-4145

FAX: (307) 766-5686

Web site: www.uwyo.edu/fcs

Department Head: Bruce A. Cameron

Professors:

DONNA M. BROWN, B.Sc. University of New South Wales, Australia 1983; Ph.D. 1987; Professor of Design, Merchandising, and Textiles 2004, 1993, 1987.

MICHAEL LIEBMAN, B.S. University of New Hampshire 1974; M.S. Virginia Polytechnic Institute and State University 1977; Ph.D. 1980; Professor of Human Nutrition and Food 1994, 1985.

VIRGINIA B. VINCENTI, B.S. Mansfield University of Pennsylvania 1968; M.S. The Pennsylvania State University 1975; Ph.D. 1981; Professor of Human Development and Family Sciences 1992.

Associate Professors:

BRUCE A. CAMERON, B.Sc. University of New South Wales, Australia 1983; Ph.D. 1986; Associate Professor of Design, Merchandising, and Textiles 1997, 1986.

D. ENETTE LARSON-MEYER, B.S. University of Wyoming 1987; M.S. MGH Institute of Health Professions, Boston 1990; Ph.D. University of Alabama at Birmingham 1998; Associate Professor of Human Nutrition and Food/Dietetics 2011, 2005.

RHODA SCHANTZ, B.S. North Dakota State University 1976; M.S. 1978; Ph.D. Kansas State University 1988; Associate Professor of Human Nutrition and Food/Dietetics 1995, 1990.

Assistant Professor:

JENNIFER HARMON, B.S. Illinois State University 2009; M.S. The Ohio State University 2013; Ph.D. 2014; Assistant Professor of Design, Merchandising, and Textiles 2015.

ERIN IRICK, B.S. Kansas State University 2000; M.S. 2006; Ph.D. Oklahoma State University 2013; Assistant Professor of Design, Merchandising, and Textiles 2013.

JILL KEITH, B.S. North Dakota State University 2000; M.S. Capella University 2009; Ph.D. North Dakota State University 2016; Assistant Professor of Human Nutrition and Food/Dietetics 2016.

ALYSSA McELWAIN, B.A. Kansas State University 2006; M.S. Purdue University 2008; Ph.D. Auburn University 2015; Assistant Professor of Human Development and Family Sciences 2015.

BERNARD STEINMAN, B.A. University of Washington 1991; M.S. Mississippi State University; Ph.D. University of Southern California 2010; Assistant Professor of Human Development and Family Sciences 2015.

CHRISTINE WADE, B.S. Willamette University 2001; M.S. University of Wyoming 2005; Ph.D. 2008; Assistant Professor of Human Development and Family Sciences 2008.

Academic Professionals:

DIANNE BARDEN, B.S. University of Wisconsin - Stout 1980; M.A. Grand Canyon University 2004; Assistant Lecturer - Coordinator Distance Degree Programs 2006.

MARK BITTNER, B.S. 1989; M.S. University of Wyoming 1993; Senior Lecturer, Human Development and Family Sciences 2012, 2008, 1991.

KRISTIN McTIGUE, B.A. Northwestern University; M.S. New York University 2009; Assistant Lecturer, Director, Didactic Program in Nutrition and Dietetics 2014.

TREVA SPROUT AHRENHOLTZ, B.S. 1993, 1997 University of Wyoming; M.S. 1995; Associate Lecturer, Design, Merchandising, and Textiles 2005, 2013.

Professor Emeritus:

Saul Feinman, Judith A. Powell, Randolph R. Weigel, Karen Williams

Our mission is to enhance the physical, social, and economic well-being of individuals, families, and communities, emphasizing healthy and sustainable living across the lifespan. We fulfill our mission through instructional, research, and outreach/extension efforts that challenge, motivate, and inspire.

Family and Consumer Sciences integrates the fundamental components of human life—food, shelter, clothing, human relationships, and family—with larger societal systems. Through programs in textiles, apparel and design; food and nutrition; and human development and family sciences, our department prepares learners to meet the opportunities and challenges of today's complex world.

All students pursuing the Bachelor of Science in Family and Consumer Sciences degree are required to complete a minimum of 120 credit hours that include a) University Studies requirements (USP); b) departmental core curriculum; and c) courses in one of the following individual options: dietetics, human nutrition and food, human development and family sciences, professional child development (online only), or design, merchandising

and textiles. Minors in apparel design, human development and family sciences, human nutrition, and interior design are also available.

Grade Requirements

Students are required to pass all courses within the Department of Family and Consumer Sciences with a grade of C or better. The university allows students only three enrollment attempts per course. Withdrawals and failed attempts count. If you do not pass the course with a grade of C or better after three attempts you could be dismissed from your family and consumer sciences major.

Security Screening

All students applying for admission to the Professional Child Development option are required to complete a security screening before they will be allowed entry into the program. Students in the Human Development and Family Sciences option must complete their security screening upon declaration of their major. In both cases, the student is responsible for the cost of this screening. Failure to satisfactorily complete this requirement will result in the student being dropped from or denied entry to the program.

Family and Consumer Sciences Core Requirements

A core curriculum is required of all family and consumer sciences majors. This requirement is based on a common body of knowledge in family and consumer sciences which contains concepts relevant to all program areas (options).

The family and consumer sciences core consists of the following courses:

FCSC 2200 Professionalism & Communication in Family and Consumer Sciences 3

Plus two courses from the list below
(depending on your FCSC program area/option)

One of the following in consultation with your advisor:

FCSC 1141 Principles of Nutrition.....3

FCSC 1150 Scientific Study of Food.....3

One of the following in consultation with your advisor:

FCSC 1180 Applied Design..... 3

FCSC 2170 Clothing in Modern Society..... 3

FCSC 2180 Housing..... 3

FCSC 3171 Introduction to Textile Science 3

FCSC 4181 Global Textiles..... 3

One of the following in consultation with your advisor:

FCSC 2110 Fundamentals of Aging &

Human Development 3

FCSC 2121 Child Development..... 4

FCSC 2131 Family Relations 3

FCSC 2133 Intimate Relationships 3

FCSC 3110 Personal Finance..... 3

FCSC 3220 Multicultural Influences on

Children and Families 3

Family and Consumer Sciences Student Learning Outcomes

Students graduating from the Department of Family and Consumer Sciences will be proficient in their program area content as well as be able to effectively communicate (both written and orally), possess intellectual skills (such as critical, creative and problem solving), and demonstrate appropriate levels of professionalism. For a more detailed description, please see the FCS Undergraduate Student Handbook.

Family and Consumer Sciences Options

Students must obtain and follow a check sheet for their chosen program area. Standards established by several professional organizations require completion of specific courses in addition to the family and consumer sciences core and USP requirements. All students are assigned a faculty advisor. Students must work closely with their advisor to be sure all requirements are met.

Dietetics

Students who complete the dietetics option meet academic requirements as approved by the Accreditation Council for Education in Nutrition and Dietetics (ACEND) of the Academy of Nutrition. Completion of this curriculum allows students to pursue a post-graduate competitive internship to become eligible to take the examination for Registered Dietitians. The Didactic Program in Nutrition and Dietetics (DPND) is currently accredited.

The following course sequence is recommended for FCSC majors who wish to apply to and be accepted into the DPND. Entrance into the DPND is made only through an application process. Each prospective DPND student will initially enter the Human Nutrition and Food option. It is recommended that students apply to the DPND in the spring semester of their sophomore year. A cumulative grade point average of 3.0 is required for program admission. Students must also have a grade

point average of at least 3.0 in the following courses: CHEM 1020, CHEM 1030, ENGL 1010, FCSC 1141, FCSC 1150, FCSC 2200, LIFE 1010, MATH 1400, MOLB 2021, PSYC 1000, and SOC 1000.

FRESHMAN YEAR: Fall	Hrs.
USP First-Year Seminar.....	3
ENGL 1010 College Composition/Rhetoric	3
FCSC 1141 Principles of Nutrition.....	3
LIFE 1010 General Biology	4
MATH 1400 College Algebra	3
Total	16

FRESHMAN YEAR: Spring	Hrs.
CHEM 1020 General Chemistry I.....	4
FCSC 1150 Scientific Study of Food.....	3
POLS 1000 American & WY Government	3
PSYC 1000 General Psychology	3
SOC 1000 Sociological Principles	3
Total	16

SOPHOMORE YEAR: Fall	Hrs.
CHEM 1030 Gen. Chemistry II	4
FCSC 2200 Professionalism and Communication in FCSC.....	3
MOLB 2021 General Microbiology	4
FCSC Nutrition Elective.....	3
Total	14

SOPHOMORE YEAR: Spring	Hrs.
CHEM 2300 Intro Organic Chemistry.....	4
STAT 2050 Fundamentals of Statistics	4
ZOO 3115 Human Systems Physiology	4
FCSC Core Elective I	3
Total	15

After admission into the DPND, students must complete the following course sequence and maintain an overall grade point average of 3.0.

JUNIOR YEAR: Fall	Hrs.
ENGL 4010 Technical Writing in the Professions	3
FCSC 3147 Community Nutrition	3
FCSC 3150 Intermediate Foods.....	2
MOLB 3610 Principles of Biochemistry	4
ZOO 2040 Human Anatomy	3
ZOO 2041 Human Anatomy Lab	1
Total	16

JUNIOR YEAR: Spring	Hrs.
FCSC 3142 Geriatric Nutrition.....	2
FCSC 3145 Sports Nutrition and Metabolism	3
FCSC 4044 Maternal, Infant, and Adolescent Nutrition	3
FCSC 4147 Nutrition and Weight Control ...	3
MOLB 4100 Clinical Biochemistry	3
Total	14

SENIOR YEAR: Fall	Hrs.
FCSC 3152 Food Systems Production	3
FCSC 4145 Advanced Nutrition	4
FCSC 4210 Therapeutic Nutrition I.....	4
MGT 3210 Management and Organization	3
Total	14

SENIOR YEAR: Spring	Hrs.
FCSC FCSC 4220 Therapeutic Nutrition II	4
FCSC 4230 Therapeutic Nutrition Counseling	2
FCSC 4150 Experimental Foods	3
FCSC Core Elective II.....	3
Elective	3
Total	15

**TOTAL MINIMUM
CREDIT HOURS 120**

Human Nutrition and Food

Students who graduate from the human nutrition and food option will be prepared to pursue careers in human nutrition, the food industry, or to pursue graduate degrees.

The following course sequence is recommended for FCSC majors in this program area. Electives should be selected in consultation with a student's advisor to ensure fulfillment of upper division and USP requirements, and to enhance the student's educational experience.

FRESHMAN YEAR: Fall	Hrs.
USP First-Year Seminar.....	3
ENGL 1010 College Composition/Rhetoric	3
FCSC 1141 Principles of Nutrition.....	3
LIFE 1010 General Biology	4
MATH 1400 College Algebra	3
Total	16

FRESHMAN YEAR: Spring	Hrs.
CHEM 1020 General Chemistry I.....	4
FCSC 1150 Scientific Study of Food.....	3
POLS 1000 American & WY Government	3
PSYC 1000 General Psychology	3
SOC 1000 Sociological Principles	3
Total	16

SOPHOMORE YEAR: Fall	Hrs.
CHEM 1030 Gen. Chemistry II	4
FCSC 2200 Professionalism and Communication in FCSC.....	3
MOLB 2021 General Microbiology	4
FCSC HNF Elective I	3
Total	14

SOPHOMORE YEAR: Spring	Hrs.
CHEM 2300 Intro Organic Chemistry.....	4
STAT 2050 Fundamentals of Statistics	4
ZOO 3115 Human Systems Physiology	4
FCSC Core Elective I	3
Total	15

JUNIOR YEAR: Fall	Hrs.
ENGL 4010 Technical Writing in the Professions	3
ZOO 2040 Human Anatomy	3
ZOO 2041 Human Anatomy Lab	1
FCSC HNF Elective II.....	3
Electives	6
Total	16

JUNIOR YEAR: Spring	Hrs.
FCSC 3142 Geriatric Nutrition.....	2
FCSC 4044 Maternal, Infant, and Adolescent Nutrition	3
FCSC 4147 Nutrition and Weight Control ...	3
Electives	6
Total	14

SENIOR YEAR: Fall	Hrs.
FCSC 4145 Advanced Nutrition	4
Upper Division Electives	9
Electives	3
Total	16

SENIOR YEAR: Spring	Hrs.
FCSC 4150 Experimental Foods	3
FCSC Core Elective II.....	3
Upper Division Electives	9
Total	15
TOTAL MINIMUM CREDIT HOURS 120	

This program includes 33 credit hours of elective courses that will allow the student to acquire a supporting minor or gain more depth in an area of emphasis. Students should consult their academic advisor about appropriate courses to best match interests and career goals.

Premedicine Career Track in Human Nutrition and Food

Students who wish to pursue the pre-medicine career track will obtain the necessary coursework to apply to medical or other appropriate professional schools. This track requires that specific substitutions and additions must be made to the general human nutrition and food curriculum (see below).

The following course sequence is recommended for FCSC majors in this program area. Electives should be selected in consultation with a student's advisor to ensure fulfillment of upper division and USP requirements, and to enhance the student's educational experience. Students should carefully research professional school admission requirements as they may require additional coursework.

FRESHMAN YEAR: Fall	Hrs.
USP First-Year Seminar.....	3
CHEM 1020 General Chemistry I	4
FCSC 1141 Principles of Nutrition.....	3
MATH 1450 Algebra and Trigonometry	5
Total	15

FRESHMAN YEAR: Spring	Hrs.
CHEM 1030 General Chemistry II	4
ENGL 1010 College Composition/Rhetoric	3
FCSC 1150 Scientific Study of Food.....	3
LIFE 1010 General Biology I.....	4
SOC 1000 Sociological Principles	3
Total	17

SOPHOMORE YEAR: Fall	Hrs.
CHEM 2420 Organic Chemistry I	4
FCSC 2200 Professionalism and Communication in FCSC.....	3
MOLB 2021 General Microbiology	4
FCSC Core Elective I	3
Total	14

SOPHOMORE YEAR: Spring	Hrs.
CHEM 2440 Organic Chemistry II.....	4
MATH 2200 Calculus I.....	4
STAT 2050 Fundamentals of Statistics	4
ZOO 3115 Human Systems Physiology	4
Total	16

JUNIOR YEAR: Fall	Hrs.
ENGL 4010 Technical Writing in the Professions	3
MOLB 3610 Principles of Biochemistry	4
PHYS 1110 General Physics I.....	4
ZOO 2040 Human Anatomy	3
ZOO 2041 Human Anatomy Lab	1
Total	15

JUNIOR YEAR: Spring	Hrs.
FCSC 3142 Geriatric Nutrition.....	2
FCSC 4044 Maternal, Infant, and Adolescent Nutrition	3
MOLB 4100 Clinical Biochemistry	3
PHYS 1120 General Physics II	4
POLS 1000 American & WY Government	3
Total	15

SENIOR YEAR: Fall	Hrs.
FCSC 4145 Advanced Nutrition	4
FCSC Nutrition Elective.....	3
PSYC 1000 General Psychology	3
Upper Division Electives	6
Total	16

SENIOR YEAR: Spring	Hrs.
FCSC 4150 Experimental Foods	3
FCSC Core Elective II.....	3
Upper Division Electives	7
Total	13
TOTAL MINIMUM CREDIT HOURS	120

This program requires 13 credit hours of electives. To strengthen the academic pre-professional program, students should carefully research professional school admission requirements before selecting electives. Courses selections should be made in consultation with an academic advisor.

Professional Child Development

The professional child development option is offered by distance delivery only but has the same quality and requirements as on-campus programs. All students are assigned an advisor who works closely with them throughout their program. Completion of this degree prepares students for teaching and administrative positions in early childhood development and care; work in resource and referral agencies; Early Head Start home visitor positions; and child advocacy. It also provides a foundation for simultaneous completion of a birth-to-five teaching endorsement, for those students who apply, or post-graduate completion of a teaching certificate in early childhood special education. The distance delivery of this program allows students who have existing A.A. or A.S. degrees in child development, early childhood education, or a closely related field to complete their bachelor's degree. Place bound students, many of whom currently work in early childhood programs, have the opportunity to earn a degree from their own hometown. Many of the courses also satisfy requirements of the Early Childhood Program Director's Certificate.

Entry into this program is by application only. Students must apply for admission to UW first. Official transcripts from all institutions attended must be submitted to UW Admissions. Applicants must also satisfactorily complete a mandatory security screen (background check). Once a student has applied and their transcripts have been received, their application will be reviewed. Transcripts will not be analyzed prior to application. In addition to an existing associate's degree, applicants must have successfully completed the following courses prior to entry.

Required Courses Before Program Entry:

SOC 1000 Sociological Principles	3
PSYC 1000 General Psychology	3
EDEC 1020 Introduction to Early Childhood Education	3
Completion of a course that meets the University Studies Program (USP) Q requirement	
Completion of a course that meets the University Studies Program (USP) COM1 requirement	
Completion of a course that meets the University Studies Program (USP) PN requirements	
Completion of a course that meets the University Studies Program (USP) V requirement	

Required Courses After Program Entry:

The following course sequence is recommended for FCSC majors in this program area. Completion of this degree requires a minimum of 120 credit hours that include 42 upper division (30 of which must be from UW). Electives should be selected in consultation with a student's advisor to ensure fulfillment of upper division and USP requirements, and to enhance the student's educational experience.

JUNIOR YEAR: Fall	Hrs.
FCSC 2121 Child Development.....	4
FCSC 2131 Family Relations	3
FCSC 2133 Intimate Relationships	3
FCSC 2200 Professionalism and Communication in FCSC.....	3
Total	13

JUNIOR YEAR: Spring	Hrs.
EDEC 3000 Observing Young Children.....	3
FCSC 3119 Parent Child Relationships	3
FCSC 3122 Adolescence.....	3
FCSC 3220 Multicultural Influences on Children and Families	3
Total	12

JUNIOR YEAR: Summer	Hrs.
FCSC 1141 Principles of Nutrition.....	3
FCSC 2050 Safety, Nutrition and Health in Early Childhood Programs.....	2
Total	5

SENIOR YEAR: Fall	Hrs.
EDEC 3220 School Programs for Young Children	3
EDEC 4320 Oral and Written Language Acquisition	3
FCSC 4124 Families of Young Children with Special Needs	3
FCSC 4127 Directing Preschool and Daycare Programs	3
Total	12

SENIOR YEAR: Spring	Hrs.
FCSC 3110 Personal Finance <i>or</i> FCSC 4112 Family Decision Making and Resource Management	3
ENGL 4010 Technical Writing in the Professions <i>or</i> ENGL 4075 Writing for Non-Profits	3
FCSC 4138 Family Stress and Coping.....	3
PSYC 4310 Developmental Psychopathology.....	3
Total	12

SENIOR YEAR: Summer	Hrs.
FCSC 2170 Clothing in Modern Society <i>or</i> FCSC 3171 Introduction to Textile Science	3
FCSC 4130 Internship in Child Development <i>or</i> FCSC 4131 Administrative Internship in Child Development.....	8
Total	11
TOTAL MINIMUM CREDIT HOURS	120

Human Development and Family Sciences

This option provides a strong foundation in the areas of human development and family sciences while allowing personalized selection of electives and internship experiences that support specific student interests. The program prepares students to work in a variety of settings, serving individuals and families across the lifespan or to pursue graduate level education. Upon declaring this program option, students must satisfactorily complete a mandatory security screen (background check).

The following course sequence is recommended for FCSC majors in this program area. Electives should be selected in consultation with a student's advisor to ensure fulfillment of upper division and USP requirements, and to enhance the student's educational experience.

FRESHMAN YEAR: Fall	Hrs.
USP First-Year Seminar.....	3
USP COM1 Elective	3
USP Q Elective	3
COJO 1030 Interpersonal Communication	3
PSYC 1000 General Psychology	3
Total	15

FRESHMAN YEAR: Spring	Hrs.
USP PN Elective	3
USP V Elective	3
SOC 1000 Sociological Principles	3
FCSC Core Elective I	3
Elective	3
Total	15

SOPHOMORE YEAR: Fall	Hrs.
FCSC 2110 Fundamentals of Aging and Human Development	3
FCSC 2121 Child Development.....	4
FCSC 2131 Family Relations	3
FCSC 2200 Professionalism and Communication in FCSC	3
Elective	3
Total	16

SOPHOMORE YEAR: Spring	Hrs.
USP PN Elective	3
FCSC 2133 Intimate Relationships	3
FCSC 3119 Parent Child Relationships	3
FCSC Core Elective II.....	3
Elective	3
Total	15

JUNIOR YEAR: Fall	Hrs.
FCSC 3110 Personal Finance.....	3
FCSC 3122 Adolescence.....	3
Electives	9
Total	15

JUNIOR YEAR: Spring	Hrs.
FCSC 3220 Multicultural Influences on Children and Families	3
FCSC 4112 Family Decision Making and Resource Management	3
FCSC 4118 Family Policy	3
Electives	6
Total	15

SENIOR YEAR: Fall	Hrs.
FCSC 4117 Understanding Community Leadership	3
FCSC 4125 Professional Practices in HDFS	3
ENGL 4075 Writing for Non-Profits <i>or</i> ENGL 4010 Technical Writing in the Professions	3
Upper Division Elective.....	3
Elective	3
Total	15

SENIOR YEAR: Spring	Hrs.
FCSC 4138 Family Stress and Coping.....	3
FCSC 4132 Internship in Human Development and Family Sciences <i>or</i> FCSC 4130 Internship in Child Development <i>or</i> FCSC 4131 Administrative Internship in Child Development	8
Upper Division Elective.....	3
Total	14

**TOTAL MINIMUM
CREDIT HOURS 120**

This program includes 33 credit hours of elective courses that will allow the student to acquire a supporting minor or gain more depth in an area of emphasis. Students should consult their academic advisor about appropriate courses to best match interests and career goals.

Design, Merchandising, and Textiles

Design, Merchandising and Textiles is a diverse and competitive field in which individuals plan, provide, and promote apparel, interiors and related goods desired by the consumer. A specialization in merchandising offers knowledge of business principles within

the fashion and interior industries; entry into the world of retailing, manufacturing, and design; involvement in marketing apparel and residential and commercial furnishings; and study and observation in all facets of fashion and interior organizations. Throughout coursework, concepts of sustainable design and manufacturing, as well as the influence of design on wellbeing will be highlighted.

Students are prepared for managing or owning small retail businesses in Wyoming and rural areas of the West, to working in the highly competitive, fast paced global industry.

The following course sequence is recommended for FCSC majors in this program area. Electives should be selected in consultation with a student's advisor to ensure fulfillment of upper division and USP requirements, and enhance the student's educational experience. A requirement of the program is that students participate in a three-credit-hour internship or international field study tour, or a study abroad program.

FRESHMAN YEAR: Fall	Hrs.
USP First-Year Seminar.....	3
ENGL 1010 College Composition/Rhetoric	3
FCSC 1170 Introduction to Apparel Construction	3
FCSC 1180 Applied Design	3
MATH 1400 College Algebra	3
Total	15

FRESHMAN YEAR: Spring	Hrs.
AGEC 1010 Principles of Macroeconomics <i>or</i> ECON 1010 Principles of Macroeconomics.....	3
FCSC 1141 Principles of Nutrition <i>or</i> FCSC 1150 Scientific Study of Food	3
FCSC 1175 Design Communication	3
POLS 1000 American & WY Government	3
SOC 1000 Sociological Principles	3
Total	15

SOPHOMORE YEAR: Fall	Hrs.
AGEC 1020 Principles of Microeconomics <i>or</i> ECON 1020 Principles of Microeconomics	3
CHEM 1000 Introductory Chemistry <i>or</i> CHEM 1020 General Chemistry I	4
FCSC 2180 Housing.....	3
FCSC 2200 Professionalism and Communication in FCSC.....	3
PSYC 1000 General Psychology	3
Total	16

SOPHOMORE YEAR: Spring	Hrs.
USP PN Elective	3
COSC 1200 Computer Information Systems	3
FCSC 2170 Clothing in Modern Society	3
FCSC 2188 Interior Design I.....	3
FCSC 3170 Advanced Apparel Construction	3
Total	15

JUNIOR YEAR: Fall	Hrs.
FCSC 3110 Personal Finance.....	3
FCSC 3173 Visual Merchandising and Promotion	3
FCSC 3184 Foundations of Merchandising I.....	3
MKT 3210 Introduction to Marketing.....	3
Elective	3
Total	15

JUNIOR YEAR: Spring	Hrs.
FCSC 3171 Intro Textile Science	3
FCSC 3172 Intro Textile Science Lab	1
FCSC 4181 Global Textile Marketplace	3
MGT 3210 Management and Organization	3
Electives	6
Total	16

SENIOR YEAR: Fall	Hrs.
FCSC 4113 Consumer Issues.....	3
FCSC 4171 Advanced Textiles	3
FCSC 4174 Foundations of Merchandising II	3
Electives	6
Total	15

SENIOR YEAR: Spring	Hrs.
FCSC 4175 Textile Testing and Product Analysis	3
FCSC 4176 Historic Clothing.....	3
FCSC 4182 Textile Industry and the Environment	3
Internship/International Study.....	3
Elective	3
Total	15

TOTAL MINIMUM CREDIT HOURS 120

This program includes 18 credit hours of elective courses that will allow the student to acquire a supporting minor or gain more depth in an area of emphasis. Consult advisor for appropriate electives.

Family and Consumer Sciences Minors

Apparel Design

A minor in apparel design is sponsored jointly by the departments of Family and Consumer Sciences and Art. It is designed to enable students with career interests in this field to gain experience in the competency

areas expected of apparel designers. This minor blends functional, artistic, and fashion considerations in the design of body coverings. Students interested in this minor should consult the sponsoring departments to receive an advisor for the minor.

Required Courses

FCSC 1170 Introduction to Apparel Construction	3
FCSC 2175 Fashion Illustration.....	3
FCSC 3170 Advanced Apparel Construction.....	3
FCSC 3171 Introductory Textile Science	3
FCSC 3174 Flat Pattern Design	3
FCSC 3175 Apparel Design Through Draping	3
FCSC 4178/5178 Fiber Arts.....	3

AND One of the following:

ART 1120 Foundation: Three Dimension.....	3
FCSC 1180 Applied Design.....	3

Minor Total 24

Human Development and Family Sciences

A minor in human development and family sciences provides students with a foundation of basic principles and knowledge. The coursework can enrich and complement a student's primary area of study. Students must complete 22 credit hours outlined below:

Required Courses

FCSC 2121 Child Development.....	4
FCSC 2131 Family Relationships.....	3
FCSC 2133 Intimate Relationships	3

Elective Courses: Choose 12 credit hours from the following (9 credit hours must be 3000-level or above):

FCSC 2110 Fundamentals of Aging & Human Development	3
FCSC 3110 Personal Finance.....	3
FCSC 3119 Parent Child Relationships	3
FCSC 3122 Adolescence.....	3
FCSC 3220 Multicultural Influences on .Children & Families.....	3
FCSC 4104 Field Studies in Family & Consumer Sciences.....	3
FCSC 4112 Family Decision Making & Resource Management	3
FCSC 4113 Consumer Issues.....	3
FCSC 4117 Understanding Comm. Leadership	3
FCSC 4124 Families of Young Children with Special Needs	3
FCSC 4127 Directing Preschool and Daycare Programs	3
FCSC 4118 Family Policy	3
FCSC 4138 Family Stress and Coping.....	3

Minor Total 22

Human Nutrition

A minor in human nutrition strengthens degrees in kinesiology and health, food science, nursing, animal science, and related fields. Students who minor in human nutrition learn how food choices can influence their health and well-being. While the coursework provides a foundation for making positive lifestyle choices, it does not prepare students to provide nutrition counseling or medical nutrition therapy.

Required Courses

CHEM 2300 Introduction to Organic Chemistry*	4
FCSC 1141 Principles of Nutrition.....	3
ZOO 3115 Human Systems Physiology*	4

Plus one of the following:

FCSC 4145 Advanced Nutrition**	4
MOLB 3610 Principles of Biochemistry*	4

Plus three of the following:

FCSC 1101 FYS: Human and Environmental Health	3
FCSC 1150 Scientific Study of Food.....	3
FCSC 2101 Special Topics in Nutrition Controversies	2
FCSC 3142 Geriatric Nutrition*	2
FCSC 3145 Sports Nutrition and Metabolism*	3
FCSC 3147 Community Nutrition*.....	3
FCSC 4044 Maternal, Infant and Adolescent Nutrition*	3
FCSC 4145 Advanced Nutrition**	4
FCSC 4147 Nutrition and Weight Control*..	3
Minor Total	23-25

*Course has prerequisites.

** Course can be used to fulfill only one category.

Interior Design

A minor in interior design is sponsored jointly by the Departments of Family and Consumer Sciences and Civil and Architectural Engineering. It is designed to enable students with career interests in this field to gain experience in the competency areas expected of interior designers. Students who hope to use this minor to prepare for professional certification examination following graduation should consult the sponsoring departments to receive an advisor for the minor.

Required Courses

FCSC 2188 Interior Design I.....	3
FCSC 4188 Interior Design II.....	3
FCSC 3171 Introductory Textile Science	3
FCSC 3172 Textile Science Laboratory.....	1
ARE 1600 Architectural Design Studio I.....	3
ARE 2600 Architectural Design Studio II...	3

Plus one of the following:

ACCT 1010 Principles of Accounting I.....	3
MGT 4500 Employee to Entrepreneur.....	3

Plus one of the following:

FCSC 1180 Applied Design.....	3
ART 1110 Foundation:	

Two Dimensional.....	3
----------------------	---

ART 1120 Foundation:	
----------------------	--

Three Dimensional.....	3
------------------------	---

ARE 3600 Architectural Design Studio II...	3
--	---

Plus one of the following:

ARE 3030 History of Architecture.....	3
ART 2020 Art History II.....	3

Minor Total **25**

Certification**Early Childhood Program Director's Certificate**

The Early Childhood Program Director's Certificate is available to early childhood professionals in the state as well as to students. The certificate program is designed to:

- fit Wyoming's Professional Career Development Competency Wheel and the Professional Development Career Lattice,
- fit the National Association for the Education of Young Children's guidelines for the Preparation of Early Childhood Professionals,
- complement the definition of Quality Child Care developed by the Wyoming Governor's Council on Early Childhood Development, and
- allow a variety of paths to certification.

Not only do these courses satisfy certification requirements for director of early childhood programs for many states but they also meet many of the requirements of a bachelor's degree in Family and Consumer Sciences. In addition, they also provide professional development for home providers and daycare professionals.

Those who would benefit from these courses include: Head Start teachers and directors; home providers; Department of Family Services, Adoption, and Social Service workers; public health nurses; school nurses; directors of school-age child care programs; preschool program teachers, and public school teachers.

Graduate Study

The department of Family and Consumer Sciences offers a program of study leading to the master of science degree in family and consumer sciences with a concentration in human development and family sciences; human nutrition and food; or textiles and merchandising. The department also participates in an interdisciplinary degree in food science and human nutrition.

Program Specific Degree Requirements**Master of Science in Family and Consumer Sciences****Plan A (thesis)**

Completion of minimum of 30 hours of course credit to include: 12 hours from FCSC, 6 hours from supporting courses, 2 hours of graduate seminar, and 10 hours of research (includes four thesis hours).

Completion of research project that adheres to a topic and format previously agreed upon by the student's graduate committee and approved by the department head.

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.

No more than nine hours of 4000-level courses will be allowed.

Plan B (non-thesis)

Completion of minimum of 30 hours of course credit to include: 12 hours from FCSC, 6 hours from supporting courses, 2 hours of graduate seminar, and 10 hours of research (includes four thesis hours).

Completion of research project that adheres to a topic and format previously agreed upon by the student's graduate committee and approved by the department head.

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.

No more than nine hours of 4000-level courses will be allowed.

Food Science and Human Nutrition Interdisciplinary Degree

Family and consumer sciences faculty participate in an interdisciplinary program that offers a master of science degree in food science and human nutrition. Please see Food Science and Human Nutrition in this catalog for more information.

Family and Consumer Sciences (FCSC)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1101. First-Year Seminar. 3. [(none)♦FYS]

1141. Principles of Nutrition. 3. This course will provide an introduction to the fundamental concepts of nutrition science and the role of nutrition in overall health. Students develop an understanding of nutritional requirements as related to metabolism of nutrients in various physiological states. Designed for nutrition majors and interested non-majors.

1150. Scientific Study of Food. 3. Comprehensive introduction to the study of food. Food science theories relative to composition are applied through the laboratory experiences.

1170. Introduction to Apparel Construction. 3. Introduction to basic and industry production techniques applied to apparel and interior products. Development of decision-making skills in selection and use of materials. (Offered spring semester)

1175. Design Communication. 3. Explores philosophical and practical factors of the design communication process. Incorporates various methods of communication design ideas and concepts from hand drawing to digital techniques through the Adobe Creative Suite.

1180. Applied Design. 3. [CA♦H] Studies design philosophy. Emphasizes application of creativity to many areas of living. (Offered both semesters)

2050. Safety, Nutrition and Health in Early Childhood Programs. 2. Designed to enrich students' understanding of practices which support children's health development. Issues to be explored include record keeping related to child care health and safety, use of health consultants, accident and injury prevention, immunizations, nutrition and food safety in child care settings. (Offered alternate summers.)

2101. Special Topics In: 1-3 (Max. 6). Provides freshman and sophomore level undergraduate students opportunities to pursue

a class of special interest or of a timely subject in a selected family and consumer sciences area and for faculty to pilot lower division courses.

2110. Fundamentals of Aging and Human Development. 3. Discusses aging as a lifelong process, involving interrelationships of the individual and his or her environment. Includes future demographic trends, family health care, social policy and mass media. *Prerequisite:* PSYC 1000 or SOC 1000.

2121. Child Development. 4. [CS♦(none)] Incorporates classroom instruction with laboratory application of child development research and theory in physical, intellectual and social/emotional domains. Emphasizes early childhood years. *Prerequisite:* PSYC 1000 or SOC 1000.

2122. Child Development Lab. 1. Laboratory observation course designed for students with a background in child development theory. Students learn child observation techniques, how to write laboratory reports, and how to apply them to evaluating a child's development in all domains. *Prerequisite:* PSYC 2300.

2131. Family Relations. 3. Provides an overview of current research on family relations, family theory, and family dynamics across the lifespan. An ecological and family systems approach is used, with particular focus paid to the understanding of contextual influences on families. *Prerequisites:* COJO 1030 or EDEC 1020 or PSYC 1000 or SOC 1000.

2133 [3133]. Intimate Relationships. 3. Use of social science theory and research to understand psycho-socio-cultural influences in the development of personal and intimate relationships including human sexuality from development and interpersonal perspectives. Emphasizes application of current research and theory to facilitate positive individual growth, satisfaction, and stability in close relationships. *Prerequisites:* PSYC 1000 or SOC 1000.

2135. Women and Aging. 3. Focuses on women and the aging process with emphasis given to both the problems and promises of aging. Topics to be explored within a multicultural, sociological framework include the definition of self, relationships, community, health and health care, work and service, retirement, economic realities and new perspectives on aging. Cross listed with WMST/SOC/NURS 2135. *Prerequisites:* ENGL/SOC/WMST 1080 or SOC 1000 or FCSC/NURS/SOC 2120.

2170. Clothing in Modern Society. 3. [WB♦COM2] Aesthetic, physical economics and socio-psychological elements of clothing selection. (Offered spring semester)

2175. Fashion Illustration. 3. Introduces the fashion figure, light and dark contrasts, color, fabric and texture sketching techniques. Computer applications for layout of the design are also covered. *Prerequisites:* FCSC 1180 or ART 1110. (Offered alternate spring semesters)

2180. Housing. 3. Cross-cultural examination of evolution of contemporary housing, both as an artifact of material culture, and as the environmental setting which affect human development and interaction. *Prerequisite:* WA. (Offered fall semester)

2188. Interior Design I. 3. Beginning interior design course. Helps students use design principles to create workable designs for interior spaces. *Prerequisites:* FCSC 1180 and sophomore standing. (Offered spring semester)

2200. Professionalism and Communication in FCSC. 3. [(none)♦COM2] An introduction to the field of Family and Consumer Sciences. Students will learn the history, approaches to problem solving using the body of knowledge and systems theory. The course will focus on professionalism and communication strategies using our departmental competencies. *Prerequisites:* FCSC majors, FYS and COM1.

3110. Personal Finance. 3. Acquaints students with personal budgeting and financial matters and relate these activities to financial institutions involved. *Prerequisite:* junior standing.

3119 [4119]. Parent-Child Relationships. 3. Research and theory related to the processes of the parent-child relationship across the lifespan. Emphasizes developmental and family theory, contexts that influence parent-child relationships and application to professional practice. *Prerequisite:* FCSC 2121 and FCSC 2131.

3122 [4122]. Adolescence. 3. Studies biological, cognitive, and social/emotional development and adjustment within the adolescent and emerging adulthood years. Emphasis on the importance of theoretically grounded research and the integration of theory, research, and practice during adolescence. *Prerequisite:* PSYC 1000.

3129. Social Development in Young Children. 3. Designed to provide professional child development and early childhood education majors with an opportunity to learn more about how to encourage healthy social development in young children. In addition, topics of self-esteem, emotional regulation, and secure attachment will be discussed in depth with regards to how they affect overall development. *Prerequisite:* FCSC 2121 or PSYC 2300.

3142 [4142]. Geriatric Nutrition. 3 (Max. 9). Studies nutrition requirements in elderly as effected by physiological changes with aging and the impact of nutrition and healthy lifestyle on prevention and treatment of age related conditions, diseases and social issues. *Prerequisites:* FCSC 1140; LIFE 1010.

3145. Sports Nutrition and Metabolism. 3. Discusses roles played by carbohydrate, fat, protein, water, and key vitamins and minerals as they relate to physical exercise. Applies principles of nutrition. *Prerequisites:* FCSC 1140 or 1141; one semester of Chemistry; ZOO 3115 or KIN 3021.

3147. Community Nutrition. 3. Provides an introduction to the field of community nutrition and develops an appreciation of the importance of nutrition in community health programs at the local, state, national, and international level. Topics covered include the role of the community nutritionist; the identification of nutrition problems; food insecurity; nutrition policy; nutrition education; assessing community resources; and program planning and evaluation. *Prerequisites:* FCSC 1141; SOC 1000 or 1100.

3150. Intermediate Foods. 2. Examines food management concepts in regards to the service of safe food, modified menu development, and understanding of federal food regulations for food and nutrition labelling. *Prerequisites:* FCSC 1150; CHEM 1020; MOLB 2021; junior standing and FCSC majors and minors.

3152 [4152]. Food Systems Production. 3. Quantity food purchasing and production, along with institutional food services experience. *Prerequisites:* FCSC 3150 and LIFE 1010. (Offered fall semester)

3170. Advanced Apparel Construction. 3. Development of advanced apparel construction and tailoring techniques. Continued development of decision-making skills in selection, use and evaluation of materials. *Prerequisites:* FCSC 1170 and FCSC 3171. (Offered fall semester)

3171 [2171]. Introductory Textile Science. 3. Understanding of textile fibers, their growth or manufacture, properties and their use and care; the major yarn manufacturing systems (cotton, worsted, woolen, and synthetic yarn texturing) and fabric manufacturing systems (weaving, knitting, and non-wovens). Introduces the physical/mechanical properties important in fibers, yarns and fabrics. *Prerequisite:* CHEM 1000 or CHEM 1020. (Offered spring semester)

3172. Textile Science Laboratory. 1. Introduces techniques in fiber, yarn and fabric identification. Examination of physical properties of textile materials. *Prerequisite:* Concurrent enrollment in FCSC 3171.

3173 [4173]. Visual Merchandising and Promotion. 3. Covers the principles of fashion, consumer behavior as it relates to promotion activities, and non-personal selling techniques to include advertising, display, publicity, fashion shows, and special events. Students will be involved in actual hands-on experiences with many techniques. *Prerequisite:* FCSC 2188. (Offered fall semester)

3174 [4170]. Flat Pattern Design. 3. Principles and instructions for drafting pattern slopers through standard or individual measurements used to learn techniques of garment design using the flat pattern method are utilized to create three-dimensional designs. Computer applications to garment design are also covered. *Prerequisites:* FCSC 2175 and 3170. (Offered fall semester)

3175. Apparel Design Through Draping. 3. Draping garment patterns through fabric manipulation, molding, and shaping to create three-dimensional form utilizing couture construction techniques. *Prerequisite:* FCSC 3174. (Offered spring semester)

3184. Foundations of Merchandising I. 3. Overviews the planning, developing and presentation of product lines in the apparel business. *Prerequisite:* ACCT 1010 or ECON 1010. (Offered alternate fall semesters)

3220. Multicultural Influences on Children and Families. 3. [CS,D♦H] Designed to enrich students' understanding of cultural contexts of children and families. Issues to be explored will include cultural values, learning styles, acquisition of concepts of race and ethnicity, bi-lingualism, the theory of bicultural/bicognitive development, and effective communication and problem-solving strategies that apply in multiple professional settings. *Prerequisite:* FCSC 2121 or PSYC 2300 or FCSC 2131.

4044 [3140]. Maternal, Infant and Adolescent Nutrition. 3. Addresses nutrition requirements prior to and during pregnancy and lactation and continuing through infancy and adolescents and the physiological and endocrine changes influencing such requirements. Discusses dietary patterns and practices and the importance of healthy lifestyles during these periods for disease prevention and treatment. Dual listed with FCSC 5044. *Prerequisites:* FCSC 1141; LIFE 1010; ZOO 3115.

4104. Field Studies in Family and Consumer Sciences. 1-3 (Max. 3). Concentrated on-site study of family and consumer sciences-related businesses, agencies and organizations to better understand challenges and potentials of various career opportunities in family and consumer sciences. *Prerequisite:* junior standing. (Offered based on sufficient demand and resources)

4105. Family and Consumer Sciences Internship. 6-8 (Max. 8). Gives students experience in workplace related to selected family and consumer sciences options (i.e., retail store, social service agency and preschool or day care). *Prerequisites:* junior standing in family and consumer sciences and consent of instructor. (Offered all semesters)

4106. Special Problems in Family and Consumer Sciences. 1-3 (Max. 8). Provides advanced undergraduate students opportunities to pursue a topic of special interest in a selected family and consumer sciences area, under guidance of a department faculty member. *Prerequisites:* junior or senior standing and advanced consultation with department head and an instructor in subject matter area. (Offered all semesters)

4112. Family Decision-Making and Resource Management. 3. Utilizes theories to facilitate understanding of problem-solving and resource management in various family structures/contexts across the life span. Emphasizes internal family dynamics, global interdependence, critical thinking, cultural examination, ethical decision-making, and self-reflection. Designed to meet family studies requirement for license in marriage and family therapy at graduate level. Companion web site used. Dual listed with FCSC 5112. *Prerequisites:* PSYC 1000 or SOC 1000 or COJO 1030 or 1040; WB/COM2. (Offered spring semester)

4113. Consumer Issues. 3. Provides research/applied understanding of consumer rights/responsibilities, government/business roles, legislation, advocacy, and redress. Emphasizes introductory consumer law/legal research, critical thinking, self-reflection, and cultural examination. Ethical theories and issues examined within an interdependent world. Meets requirements for certification in family and consumer sciences education. Internship opportunities possible upon successful completion. Companion web site used. *Prerequisites:* ECON 1000 or SOC 1000 or PSYC 1000; WB/COM2. (Offered fall semester)

4117. Understanding Community Leadership. 3. [CS♦(none)] Understanding Community Leadership. Introduces students to the scope and functions of professionals working

in rural communities as leaders. Students will explore community dynamics, leadership skills and managing change, and understand the complexities of leadership within communities. Understanding communities and leadership increases the likelihood of success for community based professionals. Dual listed with FCSC 5117. *Prerequisites:* senior standing and satisfactory completion of a WB course. (Offered fall semester)

4118. Family Policy. 3. Explores the relationships between family functioning and public/private policies. The roles of family professionals in advocacy and education regarding policies will be discussed. Attention will be paid to the policy process at the state level. Dual listed with FCSC 5118. *Prerequisites:* FCSC 2131; junior standing. (Offered spring semester, odd years)

4124. Families of Young Children With Special Needs. 3. Deals with importance of including family in the process of early intervention with the preschool child with special needs. *Prerequisites:* FCSC 2121 or PSYC 2300; junior standing.

4125. Professional Practices in Human Development and Family Sciences. 3. Explores key issues related to professional practice in Human Development and Family Sciences. Particular attention is paid to skills and knowledge needed to work in community-based, prevention focused settings with individuals and families across the lifespan. *Prerequisites:* FCSC 2110, FCSC 3119, FCSC 3122, and FCSC 3220. (Offered fall semester)

4127. Directing Preschool and Daycare Programs. 3. [WC♦(none)] Effective methods for establishing and operating preschool and day-care programs for children under six years of age. Includes programming, classroom management, parent involvement and administration of food and nutrition programs. *Prerequisites:* FCSC 2121, EDEC 1020 or 3210; junior standing. (Offered fall semester)

4130. Internship in Child Development. 6-8 (Max. 8). Provides professional child development and early childhood education majors with an in-depth experience working with children from birth to age five. Students gain experience including planning lessons, teaching, assessing children and conducting parent conferences. *Prerequisites:* FCSC 2121; EDEC 3000; EDEC 3220; senior standing.

4131. Administration Internship in Child Development. 6-8 (Max. 8). Provides professional child development and early education majors with an in-depth experience working with families and staff. Students gain experience in observing and assessing early child-

hood programs, planning and presenting staff trainings/professional workshops, staff supervision, writing newsletters, and other professional documents and professional activities. *Prerequisites:* FCSC 2121; FCSC 4127; senior standing.

4132. Internship in Human Development and Family Sciences. 6-8 (Max. 8). Acquire skills and gain familiarity in direct services, policy development, or program planning in a human services agency/organization. Opportunities to apply theories and knowledge gained in classroom settings to professional practice will be provided. *Prerequisites:* FCSC 4125; consent of instructor; senior standing. (Offered spring and summer semesters)

4138. Family Stress and Coping. 3. Theoretical and empirical research on family stress, coping and resiliency is emphasized as well as the study of normative stressors and crisis in the lives of individuals and families. Attention is paid to the application of theory and research to professional practice. Dual listed with FCSC 5138. *Prerequisites:* FCSC 2131; junior standing. (Offered spring semester)

4145. Advanced Nutrition. 4. Discusses functions of components of diet in human metabolism. Applies principles of nutrition. Dual listed with FCSC 5145. *Prerequisites:* FCSC 1141; ZOO 3115 or KIN 3115. (Offered fall semester)

4147. Nutrition and Weight Control. 3. Advanced course in physiological and metabolic determinants of weight control emphasizing pathology, psychodynamics, assessment and treatment of obesity. Dual listed with FCSC 5147. *Prerequisites:* FCSC 1140 or 1141; ZOO 3115. (Offered spring semester)

4150. Experimental Foods. 3. Studies physical and chemical properties of raw and processed food materials and tests for evaluation of food quality. Students develop ability to use and interpret recent research findings, as well as skills in planning, conducting and reporting food experiments. *Prerequisites:* FCSC 1150, CHEM 2300, STAT 2020, ENGL 4010, FCSC major. (Offered spring semester)

4171. Advanced Textiles. 3. Introduces color science as related to human perception and practical problems to the textile industry. Studies different types of dyes available, fibers to which they are applied and properties of dyes. Introduces various finishing techniques used for textiles. *Prerequisite:* FCSC 3171. (Offered fall semester)

4174. Foundations of Merchandising II. 3. Overviews fashion merchandising and retailing. *Prerequisite:* FCSC 3184 and MATH 1400. (Offered alternate fall semesters)

4175. Textile Testing and Product Analysis.

3. Explains meaning of quality control and why it is important. Discusses variety of laboratory tests and standards available to assess the various aspects of textile/apparel quality. Examines performance specifications of textile materials to determine if they are suitable for desired end uses. Dual listed with FCSC 5175. *Prerequisites:* FCSC 3170 and 4171. (Offered alternate spring semesters)

4176. Historic Clothing. 3. Surveys history of clothing in the Western World. Includes information from approximately 3000 B.C. through the 20th century. Dual listed with FCSC 5176. *Prerequisite:* FCSC 2170. (Offered alternate spring semesters)

4178. Fiber Arts. 3 (Max 6). Development and enhancement of technical and creative apparel construction/design skills culminating in the creation of a distinctive piece of wearable art. Dual listed with FCSC 5178. *Prerequisite:* FCSC 3174. (Offered spring semester)

4181. Global Textiles Marketplace. 3. [G♦(none)] Discusses global textile industry, how the U.S. fits into the global industry, textiles and apparel trade policy, as well as balancing conflicting interests in the world marketplace. Dual listed with FCSC 5181. *Prerequisite:* FCSC 3171. (Offered alternate spring semesters)

4182. Textile Industry and the Environment. 3. [WC♦COM3] Examines the environment, the impact of the textile industry on the environment, and issues facing the textile industry to provide more environmentally friendly products. Dual listed with FCSC 5182. *Prerequisite:* completion of USP WB requirement, FCSC 3171. (Offered alternate spring semesters)

4188. Interior Design II. 3. Advanced study of space planning and interior design as applied to contract design problems. Architectural design and rendering software used to visualize and present interior design solutions. Explores ideas of sustainable, accessible and functional design for the public. Dual listed with FCSC 5188. *Prerequisite:* FCSC 2188. (Offered fall semester)

4210. Therapeutic Nutrition I: Nutrition Assessment and Diagnosis. 4. Nutrition assessment and diagnosis as part of the nutrition care process; experience in dietary and nutrient assessment of the apparently healthy and sick individual with discussion of case studies. *Prerequisites:* Senior Standing; ZOO 3115; MOLB 3610; FCSC 4145 or concurrent enrollment.

4220. Therapeutic Nutrition II. 4. Rationale for dietary modifications in pathological conditions; experience with learning and applying the nutrition care process to develop nutrition

care plans for individuals with various medical conditions with discussion of case studies. *Prerequisites:* FCSC 4210; MOLB 4100 or concurrent enrollment.

4230. Therapeutic Nutrition Counseling. 2. Course is designed to help students develop basic nutrition counseling and communication skills. Students will learn how to apply the concepts learned during lecture through interactive classroom experiences with peers and outside of the classroom experiences with an assigned client. *Prerequisites:* FCSC 4220 or concurrent enrollment; Dietetics students only.

4346. Clinical Practicum in Dietetics. 1. Concentrated clinical practicum designed to provide dietetic majors with experience in the institutional, practitioner and clinical settings. *Prerequisite:* FCSC 4220 and permission of instructor. Enrollment is limited to dietetics students only.

4350. Health Management Issues in Early Education. 3. Provides the student the opportunity to examine the implications of a child's health status on his/her personal, educational, social and cognitive development. Provides personnel working closely with the young child with disabilities and his/her family an understanding of the issues related to health concerns and a framework on concerns specific to the child in a day care, preschool or other school setting. Cross listed with EDEC 4350. *Prerequisites:* junior or senior standing, 6 hours of education and/or the consent of instructor.

4546. Agriculture: Rooted in Diversity. 3. [C,D♦(none)] Addresses multiple themes related to diversity in agriculture with the goal of making visible the experiences of minorities and women in agriculture. Involves significant independent research, class discussion, project development, and development of oral and written communication skills. Establishes linkages with supporting disciplines. Cross listed with ENGL/AIST/CHST/AGRI/AMST/HIST 4546. *Prerequisites:* Junior class standing or consent of instructor and concurrent enrollment or major in any of the following: ethnic studies, agriculture, American studies, anthropology, English, history, sociology, or women's studies.

4960. Textiles Field Study Tour. 1-3 (Max. 6). Designed to provide students an opportunity to visit designer show rooms, textile manufacturers, museums, and historic/cultural sites. Serves both undergraduate and graduate students with an interest in textile and apparel design, history, and merchandising. *Prerequisites:* WA and consent of instructor. (Offered based on sufficient demand and resources every other spring/summer term, odd years)

4970. Design and Merchandising Internship. 3 (Max. 6). Provides practical experience in retail, interior design or apparel design settings. *Prerequisite:* FCSC 3173.

4985. Seminar: Development in Community Leadership. 2-3. Emphasizes basic core components of individual leadership: assessment of leadership skill and style; community-based experiences for understanding of community and resources; group community development projects for students; engagement with others and the community. Upon completion, students understand various leadership styles and philosophies and articulate their personal leadership philosophy. Dual listed with FCSC 5985. *Prerequisites:* senior or post-graduate equivalent status and consent of instructor.

5044. Maternal, Infant and Adolescent Nutrition. 3. Addresses nutrition requirements prior to and during pregnancy and lactation and continuing through infancy and adolescents and the physiological and endocrine changes influencing such requirements. Discusses dietary patterns and practices and the importance of healthy lifestyles during these periods for disease prevention and treatment. Dual listed with FCSC 4044. *Prerequisites:* FCSC 1141; LIFE 1010; ZOO 3115.

5101. Special Topics in Family and Consumer Sciences. 1-3 (Max. 6). Intended to accommodate a seminar series and a course offering by visiting faculty whose subject matter is not included in other course offerings.

5102. Special Problems. 1 - 12 (Max. 18). Study in a selected problem area for broader perspective or greater specialization in the student program. *Prerequisite:* advanced or graduate standing and consultation with department head and instructor in subject matter area.

5103. Graduate Seminar in Family and Consumer Sciences I. 1. Integrative Seminar in Family and Consumer Sciences. Students are exposed to faculty research, discuss common readings and present their own research. Offered S/U only for those taking Graduate Seminar I and students will be taking Graduate Seminar II for a letter grade. *Prerequisite:* graduate student standing.

5104. Graduate Seminar in Family and Consumer Sciences II. 1. Integrative seminar in Family and Consumer sciences. Students are exposed to faculty research, will discuss common readings, and will present their own research. Graduate Seminar II can only be taken for a letter grade. *Prerequisite:* FCSC 5103.

5107. Family and Consumer Sciences Extension Practicum. 8. To provide experience in county extension programs. *Prerequisites:* AGRI 4010, advanced standing and consent of instructor.

5112. Family Decision and Resource Management. 3. Utilizes theories to facilitate understanding of problem-solving and resource management in various family structures/contexts across the life span. Emphasizes internal family dynamics, global interdependence, critical thinking, cultural examination, ethical decision-making, and self-reflection. Designed to meet family studies requirement for license in marriage and family therapy at graduate level. Companion website used. Dual listed with FCSC 4112. *Prerequisites:* graduate standing. (Offered spring semester)

5113. Consumer Issues. 3. Provides research/applied understanding of consumer rights/responsibilities, government/business roles, legislation, advocacy, and redress. Emphasizes introductory consumer law/legal research, critical thinking, self-reflection, and cultural examination. Ethical theories and issues examined within an interdependent world. Meets requirements for certification in family and consumer sciences education. Internship opportunities possible upon successful completion. Companion website used. Dual listed with FCSC 4113. *Prerequisites:* graduate standing. (Offered fall semester)

5114. Lifespan Human Development. 3. An overview of human growth and development throughout the life span, with an emphasis on major theories, conceptual issues, research findings, and practical applications for professionals working in health care, human service and educational environments. *Prerequisite:* PSYC 1000 or FCSC 2121.

5117. Understanding Community Leadership. 3. Understanding Community Leadership. Introduces students to the scope and functions of professionals working in rural communities as leaders. Students will explore community dynamics, leadership skills and managing change, and understand the complexities of leadership within communities. Understanding communities and leadership increases the likelihood of success for community based professionals. Dual listed with FCSC 4117. *Prerequisite:* graduate standing.

5118. Family Policy. 3. Explores the relationships between family functioning and public/private policies. The roles of family professionals in advocacy and education regarding policies are discussed. Attention is paid to the policy process at the state level. Dual listed with FCSC 4118. *Prerequisite:* graduate standing. (Offered alternate spring semesters)

5120. Infancy and Toddlerhood. 3. Examines development and behavior, focusing on a broad range of topics which includes: physical development, prenatal influences, sensory processes, biological factors, cognitive development, language development, social interaction and relationship. A broad family and consumer sciences perspective (the family in its environment) are applied. *Prerequisite:* FCSC 2121 or equivalent course in child development.

5121. Ethics in Research and Professional Practice. 3. Includes ethical theories, responsible conduct of research and professional practice defined by government, professional organizations, journals, and employers. Concepts include plagiarism, fabrication, falsification, conflict of interest, and conflict of commitment, and institutional review boards protecting human subjects. Concepts will be applied to research and professional practice in different settings. *Prerequisite:* acceptance into a graduate program.

5122. Developmental Contexts Across the Lifespan. 3. A variety of contexts in which children, adults, and families live and develop. Attention is given to the constant interactions that occur between humans and their environments, as well as how different environments may foster or hinder development. Includes discussions of the practical, professional and political implications of contextual research. *Prerequisite:* graduate standing.

5129. Seminar in Child Development. 3. Advanced study of the cognitive, social-emotional, communicative, moral, and physical/motor development of children and adolescents, with an emphasis on cultural and contextual influences on development. *Prerequisites:* graduate standing, WC and one of the following: FCSC 2121, PSYC 2300, FCSC 3220, EDST 2450.

5132. Seminar in Family Studies. 3. Provides an in-depth examination of: guiding theories in family studies; the purpose and methods of theory-building; and current research in major topical areas of family science and family and consumer science are compared. *Prerequisites:* 6 hours of undergraduate family related courses and consent of instructor.

5137. Individual and Family Assessment. 3. An introduction to both quantitative and qualitative methods of assessing children, adults, couples and families; observational approaches to assessing individuals and families; and interpretation of commonly used tests and measures. *Prerequisite:* STAT 5010.

5138. Family Stress/Coping. 3. Theoretical and empirical research on family stress, coping and resiliency is emphasized as well as the study of normative and nonnormative stressors

and crises in the lives of families. Attention is paid to professional practice applications. Dual listed with FCSC 4138. *Prerequisite:* graduate standing.

5140. Nutritional Aspects of Proteins and Amino Acids. 3. Advanced study of protein and amino acid metabolism in various physiological conditions. *Prerequisites:* MOLB 3610 or equivalent; FCSC 4145 or equivalent.

5141. Carbohydrate and Ethanol Metabolism. 3. Advanced study of carbohydrate and ethanol metabolism in various physiological conditions. *Prerequisites:* MOLB 3610 or equivalent; FCSC 4145 or equivalent.

5142. Nutritional Research Techniques. 2. Techniques for nutrient analysis of body fluids and tissues, assessing nutrient status of populations, and methods for animal studies in nutrition instrumentation. *Prerequisite:* FCSC 4145/5145.

5144. Lipids II. 3. Examines lipoprotein metabolism and how it is influenced by alterations in diet composition. This area is followed by sections on prostaglandin and leukotriene biosynthesis and the regulatory role of these eicosanoids. *Prerequisite:* FDSC 5770.

5145. Advanced Nutrition. 4. Discusses functions of components of diet in human metabolism. Applies principles of nutrition. Dual listed with FCSC 4145. *Prerequisite:* graduate standing.

5147. Nutrition and Weight Control. 3. Advanced course in physiological determinants of weight control emphasizing pathology, psychodynamics, assessment, and treatment of obesity. Dual listed with FCSC 4147. *Prerequisite:* graduate standing.

5150. Experimental Foods. 3. Studies physical and chemical properties of raw and processed food materials and tests for evaluation of food quality. Students develop ability to use and interpret research findings, as well as skills in planning, conducting, and reporting food experiments. Dual listed with FCSC 4150. *Prerequisite:* graduate standing.

5151. Sensory Analysis. 1. Examines the principles and techniques applied to the subjective evaluation of food. *Prerequisites:* graduate standing; STAT 5080.

5172. Advanced Textile Chemistry. 3. A study of the chemistry of amino acids and proteins, especially silk and wool; the photochemistry of dyes and fibers; the physical chemical concepts of dyeing.

5173. Textile Science Seminar. 3. Advanced study of textile science, physical and chemical modification of fibers, developments in dyeing and finishing technology. Environmental aspects of textile technology. Extensive use of current literature is utilized.

5175. Textile Testing and Product Analysis.

3. Explains meaning of quality control and why it is important. Discusses variety of laboratory tests and standards available to assess the various aspects of textile/apparel quality. Examines performance specifications of textile materials to determine if they are suitable for desired end uses. Dual listed with FCSC 4175. *Prerequisite:* graduate standing. (Offered alternate spring semesters)

5176. Historic Clothing. 3. Surveys history of clothing in the Western World. Course content includes information from approximately 3000 BC through the 20th century. Dual listed with FCSC 4176. *Prerequisite:* graduate standing. (Offered alternate spring semesters)

5178. Fiber Arts. 3. Development and enhancement of technical and creative apparel construction/design skills culminating in the creation of a distinctive piece of wearable art. Dual listed with FCSC 4178. *Prerequisite:* graduate standing. (Offered spring semester)

5179. Historic Textiles. 3. History of all major textile industries is explored. Processes and technical terms are explained. The role and impact of textiles in western economies and societies are examined. *Prerequisite:* graduate standing. (Offered alternate fall semesters)

5181. Global Textiles. 3. To gain an understanding of the global textile industry, how the U.S. fits into the global industry, textiles and apparel trade policy and balancing conflicting interests in the world market place. Dual listed with FCSC 4181. *Prerequisite:* graduate standing. (Offered alternate spring semesters)

5182. Textile Industry Environment. 3. Examines the environment, the impact of the textile industry on the environment, and issues facing the textile industry to provide more environmentally friendly products. Dual listed with FCSC 4182. *Prerequisites:* completion of USP WB requirement, FCSC 3171. (Offered alternate spring semesters)

5188. Interior Design II. 3. Advanced study of space planning and interior design as applied to contract design problems. Architectural design and rendering software used to visualize and present interior design solutions. Explores ideas of sustainable, accessible and functional design for the public. Dual listed with FCSC 4188. *Prerequisite:* graduate standing.

5890. Seminar in Food Science and Nutrition. 1. A seminar course on topics in food science and human nutrition. Cross listed with FDSC 5890. *Prerequisite:* graduate standing.

5900. Practicum in College Teaching. 1-3. (Max 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate standing.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1-12 (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. *Prerequisites:* enrollment in a graduate degree program.

5961. Graduate Projects. 1-4 (Max. 4). Limited to those students enrolled in a Plan B graduate program. Students should be involved in non-course scholarly activities in support of their Plan B project. *Prerequisite:* must be enrolled in a Plan B program and have departmental approval.

5985. Development of Community Leadership. 2-3 (Max 98). Emphasizes basic core components of individual leadership: assessment of leadership skill and style; community based experiences for understanding of community and resources; group community development projects for student engagement with others and the community. Upon completion of course, students will understand various leadership styles and philosophies and articulate their personal leadership philosophy. Dual listed with FCSC 4985. *Prerequisites:* senior or post graduate equivalent status and consent of instructor.

5990. Internship. 1 - 12. (Max 24). *Prerequisite:* graduate standing.

Life Sciences Program

138 Aven Nelson Building,

(307) 766-4158

FAX: (307) 766-2851

Web site: www.uwyo.edu/lifescience

Program Director: Mark E. Lyford

The Life Sciences Program consists of all LIFE prefix courses. These courses support the life science majors and several non-life science majors across campus. The number of LIFE courses taken by life science and other majors is determined by the departments that offer the majors. The curriculum intends to provide life-science majors with both breadth and depth in the basic life sciences, and non-science majors with exposure to key concepts in biology and an understanding of the connections between science and society. The

program courses also expose students to the fields of cell and molecular biology, genetics, ecology, and evolution, and they familiarize students with the diversity of life on the planet. Courses within the curriculum address four fundamental goals at a level appropriate for each course: 1) Acquisition, Application and Synthesis of Knowledge, 2) Communication Skills, 3) Critical Thinking and Problem Solving, and 4) Research Skills.

For information on LIFE course offerings, please refer to the Life Sciences Program entry in the College of Arts and Sciences.

Microbiology Program

5004 Agriculture Building, (307) 766-3139

FAX: (307) 766-3875

E-mail: gandreus@uwyo.edu

Program Director: Dr. Gerard Andrews

The bachelor of science degree program in microbiology is organized as an interdepartmental major involving the collaborative teaching, advising, and research expertise of more than 20 microbiology faculty from the Colleges of Agriculture, Arts and Sciences, and Health Sciences. The program is administered by a program director and a coordinating committee which represent each of the participating colleges. Students obtain their degree in the College of Agriculture and Natural Resources. Students should contact the program director or members of the coordinating committee directly for more information or formal academic advising within the program. Additional information about the microbiology program may be obtained at the following web site address: www.uwyo.edu/agcollege/micro/microhome.htm.

Students pursuing a major in microbiology must be advised by one of the following participating faculty members of the interdepartmental Microbiology Steering Committee:

GERRY ANDREWS, Veterinary Sciences
 BLEDDAR BISHA, Animal Sciences
 JASON GIGLEY, Molecular Biology
 MARK GOMELSKY, Molecular Biology
 KUMARAN MANI, Molecular Biology
 KURT W. MILLER, Molecular Biology
 MYRNA MILLER, Veterinary Sciences
 KERRY SONDERGROTH, Veterinary Sciences
 PETER D. STAHL, ESM
 DANIEL WALL, Molecular Biology
 RACHEL WATSON, Molecular Biology

Microbiology is the study of life forms too small to be observed without the aid of magnification; major groups of microbes include the bacteria, fungi (yeasts and molds), protozoa,

and algae, as well as the viruses. In addition, related disciplines such as immunology and molecular biology are included because of their historical origins within microbiology.

As such, the science of microbiology is divided into numerous subspecialty areas that reflect not only the individual groups of microbes (e.g., bacteriology, virology, mycology, etc.), but also their significance in applied areas (e.g., medical microbiology/infectious diseases, microbial ecology, food microbiology, industrial microbiology, biotechnology, etc.) or in areas of basic science (e.g., molecular genetics). Throughout its history, microbiology has played a key role in the development of our understanding of basic biochemical and genetic processes, control of infectious diseases, production of increased and improved food supplies, and the production of numerous commercial products. With the development of molecular techniques to construct genetically engineered microbes, microbiologists will continue to make expanding contributions in these and other areas.

Because microbiology is a diverse science, individuals trained as microbiologists find exciting career opportunities in many areas of the basic and applied sciences. Typically, microbiologists are employed in five major sectors: private industry; clinical laboratories; government agencies; universities; and various other settings such as water treatment, food production/inspection facilities, and other public health-related areas. Recent manpower assessment studies at both the national and regional levels have provided evidence for a continuing and expanding need for microbiologists such that successful undergraduate students completing this program may look forward to exciting careers. In addition, undergraduates trained in the microbiological sciences are well prepared for competitive application to graduate school programs and professional programs in human or veterinary medicine, optometry or dentistry.

The microbiology curriculum is organized to provide students with the maximum flexibility in meeting their university studies program requirements. In addition, the curriculum is designed to prepare graduates for the future by combining a firm foundation in the basic sciences with a central core of microbiology classes, followed by the opportunity for students to specialize in areas of microbiology suiting their individual interests via the selection of electives. Prior to graduation, microbiology majors must complete the basic requirements and all microbiology core course

requirements as listed below. Finally, to assure breadth of exposure in microbiology, students must complete 6 semester hours of microbiology electives.

Basic Course Requirements for Microbiology Majors

Total credit hours..... 128
 3000-level or above credits

(university requirement) 42 hours
 Completion of University Studies 2003

Program Requirements..... 30-36 hours

Basic sciences and quantitative reasoning

MATH	1450, or 1400 and 1405, or 2200	4-6
STAT	2050	4
LIFE	1010 and 2022 or 2023	8
LIFE	3050	4
CHEM	1020 and 1030	8
CHEM	2420 and 2440	4-8
PHYS	1110 and 1120	4-8
MOLB	3000	3
MOLB	3610 or 4600 and 4610.....	4-6

Microbiology Core Course Requirements

MICR/MOLB	2021 or 2240	4-5
PATB	2220	4
MOLB	4440	3
PATB/MOLB	4400	4
PATB	4710	3
MOLB	4460	3
MOLB	4170	1
MOLB	4250	1
PATB	4150, or MOLB 4050 (or 4052)....	1(x2)
MICR	Electives.....	6

Microbiology Electives

In addition to completing the required microbiology courses listed above, students must complete 6 hours of microbiology electives from any of the following lists.

Medical Microbiology

PATB	4001, Epidemiology	3
PATB	4110, Diseases of Food Animals and Horses	3
PATB	4120, Diseases of Wildlife.....	3
PATB	4130, Mammalian Pathobiology	3
PATB	4140, Toxicology	3
PATB	4200, Diagnostic Bacteriology.....	1
PATB	4360, Parasitology.....	4
PATB	4500, Veterinary Parasitology.....	3
PATB	4220, Molecular Pathogenesis.....	3
PHCY	4450, Pathophysiology.....	4
ZOO	4110, HIV and AIDS.....	3

Molecular and Cell Biology

LIFE 3600, Cell Biology	4
MOLB 4180, Protein Isolation and Characterization.....	1
MOLB 4260, Quantitative Microscopy	1
MOLB 4450, Developmental Genetics	3
MOLB 4670, Adv. Molecular Cell Biology ...	3

Environmental and Applied**Microbiology**

BOT 4300, Mycology.....	4
BOT 4390, Fungal Physiology	3
MOLB 4540, Micro. Taxonomy.....	3
SOIL 4140, Soil Microbiology.....	4
PLNT 3220, Plant Pathology	3
PLNT 4000, Plant Disease Control	3
FDSC 4090, Food Microbiology	3
FDSC 4100, Food Microbiology Lab.....	1

***Students pursuing the B.S. degree in microbiology who wish to pursue a dual major in both microbiology and molecular biology must satisfy the basic science/math and core/elective requirements in microbiology as well as those specified for the B.S. degree in molecular biology PLUS an additional **9 credits of electives in microbiology and/or molecular biology at the 4000/5000 level**

Microbiology (MICR)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

2021 [2210]. General Microbiology. 4. Introduces nature and diversity of microorganisms and their implications for all of biology. Covers comparative properties of eukaryotic and prokaryotic microbes, as well as their roles as disease agents, ecological agents and model systems for understanding of fundamental biological processes at the molecular level. Cross listed with MOLB 2021. *Prerequisites:* LIFE 1010, CHEM 1000 or equivalent.

2220. Pathogenic Microbiology. 4. Covers major communicable diseases of man caused by bacteria, mycoplasma. Discusses disease, diagnosis, treatment, prevention and transmission. Cross listed with PATB 2220. *Prerequisite:* MICR 2210.

2240. Medical Microbiology. 5. Designed primarily for nursing and pre-pharmacy majors, introduces students to microbiology, including the diversity of procaryotic and eucaryotic microbes, their structural and physiological properties, and their applied medical significance; also covers the basic principles of the immune system and emphasizes the communicable diseases of man caused by microbial pathogens. Cross listed with MOLB 2240. *Prerequisite:* LIFE 1010.

4001. Epidemiology (Diseases in Population). 3. Basic epidemiologic concepts and approaches to population problems in medicine, with examples from veterinary and human health. Covers a wide spectrum of topics and introduces practical applications of epidemiology. Dual listed with MICR 5001; cross listed with PATB 4001. *Prerequisite:* STAT 2050.

4090. Food Microbiology. 3. Discusses micro-organisms and theory of their growth and survival in relation to spoilage and preservation of foods and health hazards in foods. Cross listed with FDSC 4090. *Prerequisite:* MOLB 2210.

4100. Food Microbiology Lab. 1. Lab techniques used in food microbiology. Cross listed with FDSC 4100. *Prerequisite:* FDSC 4090 or 5090, taken concurrently.

4130. Mammalian Pathobiology. 3. Anatomical basis of disease in mammals. Emphasis on concepts of pathogenesis of disease, and the gross, microscopic and clinicopathological changes associated with lesions: cell injury and death; cellular degeneration; disturbances of growth and circulation; neoplasia; inflammation; and recognition of gross and microscopic tissue changes. Background in immunology will be beneficial. Dual listed with MICR 5130; cross listed with PATB 4130. *Prerequisite:* C or better in LIFE 2022.

4140. Soil Microbiology. 4. Fundamental principles of soil microbiology and how they relate to microbial ecology, environmental contamination, agriculture and forestry. Dual listed with MICR 5140; cross listed with SOIL 4140. *Prerequisite:* SOIL 2010.

4200. Diagnostic Bacteriology. 1. Practical training with emphasis on diagnostic procedures used in a clinical microbiology laboratory. Students identify bacterial pathogens of animals and humans. Taught in a clinical setting utilizing selected clinical material. Techniques employed in the processing and identification of clinically significant bacteria are used and discussed. Safe laboratory practices for working with biohazards are presented. Cross listed with PATB 4200. *Prerequisites:* junior standing and a MICR course which included a laboratory.

4220. Molecular Mechanisms of Bacterial Pathogenesis. 3. Intended for students majoring in microbiology or a related field. The class will consist of lectures and small group decisions. Student responsibilities will include note-taking and preparation for discussion by completion of reading assignments consisting of classic and/or recent journal articles addressing the weekly topic. Cross listed with

PATB 4220; dual listed with MICR 5220.

Prerequisites: PATB/MICR 2220 and statistics (or epidemiology).

4250. Bacterial Genetics Laboratory. 1. Introduces genetic manipulations of bacteria using molecular genetic techniques. Cross listed with MOLB 4250. *Prerequisites:* MOLB 2021, MOLB 3000, and LIFE 3050.

4321. Microbiology Capstone. 3. [(none) ♦COM3] Using a problem-based student learning model, students conceptualize, propose, perform and present a microbiology research study to address a real community problem. Students maintain a lab notebook, write an NSF-style research proposal, formulate hypotheses, engage in hands-on laboratory hypothesis testing and design and present a scientific poster. *Prerequisite:* MICR majors with junior or senior standing.

4360. Medical Entomology and Parasitology. 4. Emphasis on medically important arthropods, protozoa, and worms; clinical effects of infection epidemiology avoidance/control and identification/diagnosis. PATB/ENTO 4360. *Prerequisite:* 8 hours of biological science.

4440. Microbial Genetics. 3. Discusses microbial genetic approaches to study cell function and provides a molecular foundation for understanding how genes work to elicit phenotypes. Dual listed with MICR 5440; Cross-listed with MOLB 4440. *Prerequisites:* MOLB 2021 and 3000 and LIFE 3050. (Normally offered spring semester).

4460. Microbial Physiology. 3. Studies life processes of microbes as mediated by their structures acting in consort, in response to changing environments. Cross listed with MOLB 4460. *Prerequisites:* MOLB 2021 or MOLB 2240 or MICR 2021 or MICR 2240, and MOLB 3610 or MOLB 4610. (Normally offered fall semester).

4500. Veterinary Entomology and Parasitology. 3. Biology, importance and control of arthropod, helminth and protozoan parasites of food and companion animals. Diagnosis and identification of live and preserved specimens. Cross listed with ENTO 4500. Cross listed with PATB/ENTO 4500. *Prerequisite:* 8 hours of biological science.

4540. 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 4540, ECOL 4540. *Prerequisite:* MOLB 2021.

4710. Medical Virology. 3. Human and animal viruses as biological entities. Methods of study, classification, replication strategies, diagnostic approaches, epidemiology and significance as disease agents. Cross listed with PATB 4710. *Prerequisite:* MOLB 2220 or MOLB 2240.

5001. Epidemiology (Diseases in Population). 3. Basic epidemiologic concepts and approaches to population problems in medicine, with examples from veterinary and human health. Covers a wide spectrum of topics and introduces practical applications of epidemiology. Dual listed with MICR 4001; cross listed with PATB 5001. *Prerequisite:* STAT 2050.

5130. Mammalian Pathobiology. 3. Anatomical basis of disease in mammals. Emphasis on concepts of pathogenesis of disease, and the gross, microscopic and clinicopathological changes associated with lesions: cell injury and death; cellular degeneration; disturbances of growth and circulation; neoplasia; inflammation; and recognition of gross and microscopic tissue changes. Background in immunology will be beneficial. Dual listed with MICR 4130; cross listed with PATB 5130. *Prerequisite:* C or better in LIFE 2022.

5140. Soil Microbiology. 4. Fundamental principles of soil microbiology and how they relate to microbial ecology, environmental contamination, agriculture and forestry. Dual listed with MICR 4140; cross listed with SOIL 5140. *Prerequisite:* SOIL 2010.

5220. Molecular Mechanisms of Bacterial Pathogenesis. 3. Intended for students majoring in microbiology or a related field. Consists of lectures and small group discussions. Student responsibilities include note-taking and preparation for discussion by completion of reading assignments consisting of classic and/or recent journal articles addressing the weekly topic. Dual listed with MICR 4220; cross listed with PATB 4220/5220. *Prerequisites:* PATB/MICR 2220 and statistics (or epidemiology).

5440. Microbial Genetics. 3. Discusses microbial genetic approaches to study cell function and provides a molecular foundation for understanding how genes work to elicit phenotypes. Dual listed with MICR 4440; Cross-listed with MOLB 5440. *Prerequisites:* MOLB 2021 and 3000 and LIFE 3050. (Normally offered spring semester).

Department of Molecular Biology

203 Animal Science/Molecular Biology Bldg., (307) 766-3300

6012 Agriculture Building, (307) 766-2171

FAX: (307) 766-5098

Web site: www.uwyo.edu/MolecBio/

Department Chair: Peter E. Thorsness

Professors

DAVID FAY, B.S. Tufts University 1988; Ph.D. Yale University 1995; Professor of Molecular Biology 2010, 2001.

MARK GOMELSKY, B.S. Moscow Institute of Chemical Technology 1986; M.S. 1988; Ph.D. Institute of Genetics and Selection of Industrial Microorganisms 1991; Professor of Molecular Biology 2011, 1999.

DONALD L. JARVIS, B.S. Idaho State University 1978; M.S. 1980; Ph.D. Baylor College of Medicine 1986; Professor of Molecular Biology 2000, 1998.

KURT W. MILLER, B.S. Pennsylvania State University 1977; Ph.D. Boston University 1982; Professor of Molecular Biology 2007, 1992.

DON ALLEN ROTH, B.S. University of New Hampshire 1974; M.S. Virginia Polytechnic Institute and State University 1975; Ph.D. 1978; Professor of Molecular Biology and Pharmacy 2009, 1978; Deputy Director of the School of Energy Resources.

ANNE W. SYLVESTER, B.S. University of Washington 1980; M.S. 1982; Ph.D. 1987; Professor of Molecular Biology 2010, 2006.

PETER E. THORSNESS, B.A. Colorado College 1982; Ph.D. University of California-Berkeley 1987; Professor of Molecular Biology 2002, 1991.

CYNTHIA WEINIG, B.A. Brown University 1991; Ph.D. Indiana University; Professor of Botany and Molecular Biology 2013, 2007.

Associate Professors

JESSE C. GATLIN, B.S. University of Colorado-Boulder 1995; Ph.D. University of Colorado-Aurora 2005; Associate Professor of Molecular Biology 2016, 2010.

PAMELA J. LANGER, B.S. Indiana University-Indiana 1973; Ph.D. Massachusetts Institute of Technology 1980; Associate Professor of Molecular Biology 1994, 1987.

DANIEL L. LEVY, B.S. California Institute of Technology 2000; Ph.D. University of California San Francisco 2006; Associate Professor of Molecular Biology 2016, 2011.

MARK M. STAYTON, B.S. University of Missouri at Kansas City 1975; Ph.D. Iowa State University 1980; Associate Professor of Molecular Biology 1994, 1988.

DANIEL WALL, B.A. Sonoma State University 1988; Ph.D. University of Utah 1994; Associate Professor of Molecular Biology 2013, 2007.

NAOMI WARD, B.Sc. University of Queensland 1993; Ph.D. University of Warwick 1997; Associate Professor of Molecular Biology and Botany 2013, 2007.

Assistant Professors

GRANT BOWMAN, B.S. University of Rochester 1997; Ph.D. University of Chicago 2004; Assistant Professor of Molecular Biology 2012.

JASON GIGLEY, B.S. University of New Hampshire 1994; Ph.D. Dartmouth Medical School 2007; Assistant Professor of Molecular Biology 2012.

Adjunct Professors

DAVID A. LIBERLES, B.S. B.A. Oberlin College 1991; M.S. California Institute of Technology 1995; Ph.D. 1997; Associate Professor of Molecular Biology 2010, 2005.

HERMANN SCHÄTZL, M.D. Max von Pettenkofer-Institut für Hygiene und Mikrobiologie, Germany 1991; Wyoming Excellence Chair – Prion Biology; Professor Veterinary Science and Molecular Biology, 2009.

Professors Emeritus

Dale Isaak, Randy Lewis, Nancy Petersen, Jordanka Zlatanova

Modern biology is based on a fundamental understanding of molecular processes. Recent advances in molecular biology have led to an explosion of knowledge about gene expression and the role gene products play in cell function. Undergraduate programs in molecular biology offer learning opportunities at the forefront of modern biology.

The molecular biology degree programs are designed to prepare students for the future by combining a foundation in basic sciences and humanities with a broad selection of courses in molecular biology, biochemistry, genetics and microbiology. Advanced undergraduates attend an outside speaker's program that includes some of the world's best-known scientists. Modern, well-equipped teaching and research laboratories contribute significantly to the educational experience of a student. All junior- and senior-level undergraduates are encouraged to participate in research projects with individual faculty members. Involvement in an active research program provides the student with an additional dimension of learning beyond what is assimilated in courses. A student learns to plan experiments, solve technical problems and experience scientific advances

first hand. An undergraduate research project also promotes close interaction between the undergraduate and graduate students, postdoctoral researchers, staff and faculty.

Many molecular biology majors continue their education beyond the bachelor's level by going to graduate school or to medical, dental or veterinary school. Some students choose to use their education to gain employment in biotechnology, clinical or basic research laboratories. Other career choices include teaching, medical technology, law and business.

To obtain a B.S. degree in molecular biology, a student, with the aid of a molecular biology adviser, designs a program of study that includes courses from the Molecular Biology Core Requirements and Electives listed below. Additional course lists are provided as an aid in developing an individualized program of study in key Interest Areas such as Biochemistry, Cell and Molecular Genetics, Computational Molecular Biology, Microbiology, and Preprofessional Health Sciences studies. Courses listed under the Interest Areas are optional and the student and adviser will design a unique curriculum suited to the student's personal interests. Flexibility in course selection also permits students to fulfill the various requirements for postgraduate and professional schools. Completion of a B.S. in Molecular Biology provides a student with the tools needed to open the door to exciting futures in science, medicine and agriculture.

We expect that our graduating students will have a strong foundation in basic science, biochemistry and molecular biology that will enable them to:

1. understand the basis of multiple molecular mechanisms central to gene expression;
2. utilize molecular and microbiological laboratory techniques in future jobs or programs and trouble-shoot experimental challenges;
3. apply for graduate programs in molecular biology, microbiology or other life sciences;
4. begin employment as a laboratory research assistant in academia or the medical or agricultural biotechnology industries;
5. utilize a background in biochemistry, cell and molecular biology to promote success in the basic science curriculum in medical or other health professional schools;

6. integrate a background in biochemistry, cell and molecular biology into career development in professions such as law, genetic counseling, or public health policy;
7. employ evidence-based scientific reasoning skills in evaluating the use of molecular genetics in the prevention, diagnosis and treatment of medical disorders.

Requirements for Molecular Biology Majors

General Requirements	Hours
Total credits (college requirement)	120
3000-level or above	
(university requirement)	42
Fulfillment of University Studies Program (consult adviser)	
Fulfillment of molecular biology general science, core and elective requirements listed below	

MOLB Requirements	Hours
<i>1. General Science Requirement</i>	
LIFE 1010	4
MOLB 2021	4
LIFE 3050	4
CHEM 1020 and 1030	8
CHEM 2420 and 2440	8
PHYS 1110 and 1120	8
MATH 2200*	4
STAT 2050	4
Total	44

*The alternative math courses MATH 1450 or 1400 and 1405 may be substituted with adviser approval.

<i>2. MOLB Core Requirement</i>	
MOLB 3000	3
MOLB 4600 and 4610 and 4615	9
MOLB 4320	4
MOLB 4485	1
MOLB 4050 and 4051 or 4052	2
Total	19

<i>3. MOLB Advanced Core Requirement</i>	
MOLB 4440 or 4450 or 4670	3
Total	3

<i>4. MOLB Elective Requirement (9 hours)</i>	
<i>Courses from the following list that were not used to fulfill the MOLB Advanced Core Requirement may be applied to the MOLB Elective Requirement; a maximum of 3 credits of MOLB 4010 may be counted toward the MOLB Elective Requirement.</i>	
MOLB 4010	1-3
MOLB 4100	3
MOLB 4260	1
MOLB 4400	4
MOLB 4440	3
MOLB 4450	3

MOLB 4460	3
MOLB 4495	3
MOLB 4540	4
MOLB 4670	3
MOLB 5650	3

Molecular Biology Interest Areas

After discussing individual interests with a molecular biology adviser, a student should enroll in additional courses that will enhance preparation for a chosen career objective. Listed below are recommended courses that will further develop a student's skills and understanding in five Interest Areas.

Biochemistry	Hours
CHEM 2230	4
CHEM 3550 or 4507 and 4508	3-6
CHEM 4230	4
CHEM 4400	3
CHEM 4560	3
CHE 4100	3
COSC 1010 or 1030 or 1100	3-4
MOLB 4010	6
MOLB 4460	3
MOLB 5650	3

Cell and Molecular Genetics	Hours
MOLB 4010	6
MOLB 4260	1
MOLB 4440	3
MOLB 4450	3
MOLB 4670	3
ZOO 4280	3
ZOO 4340	4

Computational Molecular Biology	Hours
COSC 1010 or 1030 or 1100	3-4
COSC 2030	4
IMGT 2400	3
IMGT 3400	3
MOLB 4010	6
MOLB 4495	3
MOLB 5650	3
BOT 4550	4
CHEM 4560	3
STAT 3050	3
STAT 4255	3
STAT 5380	4

Microbiology	Hours
MICR 2220	4
MICR 4130	3
MICR 4220	3
MICR 4360	4
MOLB 4010	6
MOLB 4400	4
MOLB 4440	3
MOLB 4460	3
MOLB 4540	4
PATB 4710	3

Preprofessional Health Sciences		Hours
MOLB	4010	6
MOLB	4100	3
MOLB	4400	4
MOLB	4450	3
MOLB	4670	3
MICR	2220	4
PATB	4710	3
PHCY	4450	4
PSYC	1000	3
PSYC	2210 or 2340	3
SOC	1000	3
SOC	3550	3
ZOO	2040/2041	3-4
ZOO	3115	4
ZOO	4125	4
ZOO	4280	3
ZOO	4340	4
ZOO	4670	4

Recommended Course Sequence

In order to fulfill course prerequisites in a timely manner, the following sequence of courses relevant to the MOLB BS degree requirements is recommended. A complete sequence of recommended courses fulfilling all university and MOLB degree requirements is listed in the Molecular Biology 4-year plan, available on the web or by request from the department. In consultation with a student's advisor, electives should be selected to fulfill University Studies requirements and to enhance a student's educational background.

Note that this example course sequence does not include specified credits for undergraduate research, summer courses, or study abroad experiences. Many students opt to complete their undergraduate courses in five years in order to take full advantage of the educational and undergraduate research opportunities in the Department of Molecular Biology.

FRESHMAN YEAR: Fall		Hrs.
LIFE	1010	4
CHEM	1020	4
USP First-Year Seminar		3
MATH	2200	4

FRESHMAN YEAR: Spring		Hrs.
MOLB	2021	4
CHEM	1030	4
USP COM1		3
STAT	2050	4

SOPHOMORE YEAR: Fall		Hrs.
MOLB	3000	3
CHEM	2420	4
USP COM2		3

SOPHOMORE YEAR: Spring		Hrs.
MOLB	4600	3
CHEM	2440	4

JUNIOR YEAR: Fall		Hrs.
MOLB	4610	3
PHYS	1110	4
MOLB	4485	1
LIFE	3050	4

JUNIOR YEAR: Spring		Hrs.
MOLB	4615	3
PHYS	1120	4
MOLB	4320	4
MOLB	4000-level	3

SENIOR YEAR: Fall		Hrs.
MOLB	4000-level	6-7
MOLB	4050	1

SENIOR YEAR: Spring		Hrs.
MOLB	4000-level	3-6
MOLB	4051	1

Requirements for Undergraduate Minor in Molecular Biology

Students wishing to minor in molecular biology should discuss their plans with an adviser in the Department of Molecular Biology. Formal declaration of molecular biology as a minor requires 1) submission of a form that must be approved by the Department of Molecular Biology and the College of Agriculture and Natural Resources Dean's Office, 2) appointment of a minor adviser from the Department of Molecular Biology.

To receive a minor in molecular biology, a student must complete courses listed in the following areas:

Science Foundation course requirements

	Hrs.
LIFE 1010	4
LIFE 3050	4
CHEM 1020 and 1030	8
CHEM 2300 or 2420 and 2440	4-8
MATH 2200 or 1450 or 1400 and 1405	4-6

MOLB course requirements		Hrs.
MOLB	2021	4
MOLB	3000	3
Lab course MOLB 4320 or 4010		3-4
MOLB 3610 and 5 additional MOLB credits or MOLB 4600 and 4610 and 3 additional MOLB credits (excluding MOLB 4010, 4050, 4051, 4052 and 4850). MOLB 4615 is recommended.		9

Graduate Study

The Department of Molecular Biology offers the Ph.D., M.S. and M.A. degrees for students who wish to do graduate work in molecular biology, in preparation for careers in academia, the biotechnology industry, medicine, or other professions. Prospective graduate students should visit the Molecular Biology Departmental web site (www.uwyo.edu/molecbio/) or the Graduate Program in Molecular and Cellular Life Sciences web site (www.uwyo.edu/mcls/) for more information.

Program Specific Admission Requirements

A prospective student must apply to a Molecular Biology Department faculty member with whom they wish to work (www.uwyo.edu/molecbio/faculty-and-staff/). Once a mentor has been identified, the student should apply to the graduate program of choice.

Candidates for all molecular biology graduate programs must have attained minimum entrance requirements, as specified by:

(1) Department of Molecular Biology graduate admission requirements, posted at www.uwyo.edu/molecbio/, and

(2) University of Wyoming Graduate Student Regulations and policies, posted on the Office of the Registrar website: www.uwyo.edu/registrar/university_catalog/grad_students.html

Instructions for applying to the Molecular Biology Graduate Degree Programs are posted at www.uwyo.edu/molecbio/degree-programs/index.html.

Program Specific Degree Requirements

Throughout the degree program, a graduate student is guided and evaluated by the research adviser and graduate committee. Here we provide only general descriptions of degree programs. Details of coursework and other requirements for obtaining a Ph.D., M.S. or M.A. degree in Molecular Biology are specified in the Departmental Policies for the Graduate Programs, listed by date of program entrance on the departmental website (www.uwyo.edu/molecbio/).

Doctor of Philosophy in Molecular Biology (Ph.D.)

The Ph.D. is a research-intensive degree. The student conducts a guided research project in the laboratory into which they have been accepted. The faculty research adviser is responsible for financial support of the student.

A student will conduct a research project that is expected to result in multiple publications in research journals as well as presentations in the department and at scientific meetings. Student performance is monitored by a dissertation committee that will evaluate a student's research proposal, preliminary examination, seminar presentations, written dissertation, final public seminar, and final oral defense of the dissertation. In consultation with the faculty research adviser, a student may elect to be a teaching assistant. Students pursuing the Ph.D. degree in Molecular Biology usually complete their program in about five years.

Master of Science in Molecular Biology (M.S.)

An M.S. degree student will conduct a research project that is expected to result in publication in research journals as well as presentations in the department and at scientific meetings. Student performance is monitored by a thesis committee that will evaluate a student's research proposal, seminar presentations, written thesis, final public seminar, and final oral defense of the thesis. In consultation with the faculty research adviser, a student may elect to be a teaching assistant. A student should not have expectations of financial support, however funding may be negotiated on an individual basis and is at the discretion of the faculty research adviser. Students pursuing the M.S. degree in Molecular Biology usually complete their program in about two years.

Undergraduate students interested in a combined bachelor of science and master of science (B.S./M.S.) program should contact the Molecular Biology Graduate Program Chairperson.

Master of Arts in Molecular Biology (M.A.)

Students interested in graduate study but who intend to apply for a post-graduate professional program such as medical or law school, should consider an M.A. program of study. An M.A. degree candidate will negotiate with their faculty adviser to formulate an appropriate research project. Student performance is monitored by a thesis committee that will evaluate a student's written thesis, final public seminar, and final oral defense of the thesis. A student pursuing an M.A. degree should not have expectations of financial support. Students pursuing the M.A. degree in Molecular Biology usually complete their program in two academic semesters plus two summers.

Molecular Biology (MOLB)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1101. First-Year Seminar. 3. [(none)♦FYS] 2021 [2210]. General Microbiology. 4. Introduces nature and diversity of microorganisms and their implication for all of biology. Covers comparative properties of eukaryotic and prokaryotic microbes, as well as their roles as disease agents, ecological agents, and model systems for understanding of fundamental biological processes at the molecular level. Cross listed with MICR 2021. *Prerequisites:* A grade of C or better in LIFE 1010 and CHEM 1000 or 1020.

2240. Medical Microbiology. 4. Designed primarily for nursing and pre-pharmacy majors. Introduces microbiology, including the diversity of prokaryotic and eukaryotic microbes, their structural and physiological properties, and their applied medical significance. Covers the basic principles of the immune system and emphasizes the communicable diseases of man caused by microbial pathogens. Normally offered spring semester. Cross listed with MICR 2240. *Prerequisites:* LIFE 1010.

3000. Introduction to Molecular Biology. 3. An introduction to molecular biological processes governing cellular events is presented in the context of the structure of genomes, genes and chromosomes, DNA replication, gene expression, signal transduction pathways and the regulation of cellular processes in disease and development. Experimental methods and technologies will also be discussed. Normally offered fall and summer semesters. *Prerequisites:* LIFE 1010 and CHEM 1030; MOLB/MICR 2021 recommended.

3610. Principles of Biochemistry. 4. One-semester biochemistry course for life-, health- and physical-science students. Introduces a full range of biochemical concepts including discussion of major macromolecules, metabolism, and molecular biology. Credit cannot be earned in MOLB 3610 and MOLB 4600 or MOLB 4610. *Prerequisites:* LIFE 1010 and a grade of C or better in CHEM 2300 or 2420. (Normally offered fall and summer semesters)

4010. Laboratory Research in Molecular Biology. 1-3 (Max. 12). Undergraduate student will conduct a laboratory or computational research project under the guidance of a Molecular Biology Department faculty member, who will serve as the student's research adviser. *Prerequisites:* LIFE 1010 or concurrent enrollment, and consent of instructor.

4050. Student Seminar. 1 (Max. 4). Exposes students to current topics in molecular biosciences and examines primary journal literature with oral presentations and class discussions. Offered Satisfactory/Unsatisfactory only. *Prerequisites:* MOLB 3000 and 3610 or 4600. (Normally offered fall and spring semesters)

4051 [4050]. Departmental Seminar. 1 (Max. 15). Attend a series of weekly seminars on a diverse set of research topics presented by visiting faculty or research scientists and will participate in a discussion following the seminar. Satisfactory/Unsatisfactory only. Dual listed with MOLB 5051. *Prerequisite:* MOLB 3000 or 3610 or 4600. (Normally offered fall and spring semesters).

4052. [4050]. Summer Seminar. 1 (Max. 5). Consists of one week of lectures, presented by a renowned scientist from either academics or industry. The material presented is taken from the research program of the speaker. Offered Satisfactory/Unsatisfactory only. Dual listed with MOLB 5052.

4100 [3980]. Clinical Biochemistry. 3. An integrated discussion of biochemical, molecular, and physiological principles underlying human medical disorders and the biochemical and molecular genetic tests used in prevention, diagnosis and treatment. *Prerequisite:* MOLB 3610 or 4600. (Normally offered spring semester)

4260. Quantitative Microscopy. 1. Acquaints students with principles of light microscopy, use of fluorescent probes and image processing software. Students use phase contrast, fluorescent, and confocal microscopes learning to measure and compare size and intensity of images. Dual listed with MOLB 5260. *Prerequisites:* MOLB 4600 or LIFE 3600, and PHYS 1120.

4320. Investigations in Molecular Biology. 4. [(none)♦COM3] Research project of the type experienced by graduate students or research associates in academic or commercial settings. Student performance, engagement and understanding will be assessed through written assignments (literature reviews, lab reports), digital communication (electronic research notebook, data presentation) and oral communications (literature presentation, research effort report). *Prerequisite:* grade of C or better in MOLB 3610 or MOLB 4610.

4400. Immunology. 4. Biology of immune system; cellular and molecular mechanisms; host resistance to infectious agents; as well as hypersensitivities, autoimmunity, tumor and tissue rejection. Includes laboratory for immunological techniques. Cross listed with PATB 4400. Dual listed with MOLB 5400. *Prerequisite:* PATB 2220. (Normally offered fall semester)

4440. Microbial Genetics. 3. Discusses microbial genetic approaches to study cell function and provides a molecular foundation for understanding how genes work to elicit phenotypes. Dual listed with MOLB 5440; Cross-listed with MICR 4440. *Prerequisites:* MOLB 2021 and 3000 and LIFE 3050. (Normally offered spring semester)

4450. Cell and Developmental Genetics. 3. Integrates the genetic control of cell regulation and animal development in both vertebrate and invertebrate model systems such as *Drosophila*, *C. elegans* and the mouse. Includes studies of eukaryotic signal transduction, gene control, and current transgenic technologies. Dual listed with MOLB 5450. *Prerequisites:* MOLB 3000 and MOLB 4600 and LIFE 3050.

4460. Microbial Physiology and Metabolism. 3. Studies life processes of microbes as mediated by their structures acting in consort, in response to changing environments. Cross-listed with MICR 4460. Dual listed with MOLB 5460. *Prerequisites:* MOLB 2021 or MOLB 2240 or MICR 2021 or MICR 2240, and MOLB 3610 or MOLB 4610. (Normally offered fall semester)

4485. Computers in Biology. 1. Prepares students to use existing internet resources as research tools in biology without the need to write or install software. Topics include literature searching, multiple sequence alignment and phylogenetic tree construction, primer design, protein homology modeling, and the use of model organism databases. Dual listed with MOLB 5485. *Prerequisites:* MOLB 3000, 3610 or 4610, or LIFE 3600.

4495. Bioinformatics. 3. Course topics range from classic algorithms in bioinformatics like multiple sequence alignment and phylogenetic tree construction to problems of functional analysis, including computational genomics, gene expression, protein structure, and systems biology analyses. Dual listed with MOLB 5495. *Prerequisite:* MOLB 3000 or 3610 or 4610 (MOLB 3610 or 4610 may be taken concurrently with MOLB 4495).

4540. 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 MICR 4540, ECOL 5540; Dual listed with MOLB 5540. *Prerequisite:* MOLB 2021.

4600. Biochemistry 1: Biomolecules. 3. Discussion of the structure and function of major biomolecules, including proteins, carbohydrates, nucleic acids and lipids, will provide the foundation for understanding biochemical, molecular and cellular processes. Dual listed with MOLB 5600. *Prerequisites:* Grade of C or better in both MOLB 3000 and CHEM 2420 or 2300. (Normally offered spring semester)

4610. Biochemistry 2: Bioenergetics & Metabolism. 3. Energy transduction and the central biochemical processes are discussed with an emphasis on regulatory controls and integration in metabolism. Dual listed with MOLB 5610. *Prerequisite:* Grade of C or better in MOLB 4600 or consent of instructor. (Normally offered fall semester)

4615. Biochemistry 3: Molecular Mechanisms. 3. Biochemical and molecular mechanisms underlying cell function, including gene expression and epigenetic regulation, RNA and protein modification and function, assembly of macromolecular complexes, signaling and regulation of the cell cycle, are discussed. Dual listed with MOLB 5615. *Prerequisites:* Grade of C or better in MOLB 4610 or consent of instructor. (Normally offered spring semester)

4670. Advanced Molecular Cell Biology. 3. Key concepts in eukaryotic cell biology will be presented with a focus on cellular processes that form the basis for human diseases. Cellular organization, dynamics, and signaling will be emphasized. Students will also explore principles of research design by critical reading and discussion of scientific literature. Dual listed with MOLB 5670. *Prerequisites:* MOLB 3000 or 3610 or 4610.

4850. Undergraduate Teaching Internship. 1 (Max. 4). Undergraduate student will assist in classroom or laboratory teaching under the guidance of an instructor in Molecular Biology. Offered Satisfactory/Unsatisfactory only. *Prerequisites:* junior standing and consent of instructor.

4990 Topics In: ____ 1-3 (Max. 6). Lectures, literature reviews and discussion of selected current topics in different areas of molecular biology. Please check class schedule for current offerings each semester. *Prerequisites:* MOLB 3000 or 3610 or 4600.

5010. Advanced Laboratory Research in Molecular Biology. 1-3 (Max. 18). Students in PhD, MS and MA programs in Molecular Biology and doctoral students in the Molecular and Cellular Life Sciences (MCLS) graduate program, work in laboratory or computational

research projects under the guidance of a Molecular Biology faculty member. *Prerequisites:* graduate standing and consent of instructor.

5050. Advanced Student Seminar. 2 (Max. 8). Introduction of reading, analyzing, and discussing primary sources in scientific literature. Read primary research papers, give presentations with full participation in critical discussions of data and interpretations of all journal articles analyzed. Papers chosen for review are typically related to research of Molecular Biology Departmental Seminar Series speakers. Offered Satisfactory/Unsatisfactory only. *Prerequisites:* MOLB 3000 and 3610 or 4600. (Normally offered fall and spring semesters)

5051. Department Seminar. 1 (Max. 15). Required attendance at a series of weekly seminars presented by visiting faculty on a diverse set of research topics. Undergraduates are able to use one credit hour to partially fulfill the seminar requirement. S/U only. Dual listed with MOLB 4051. *Prerequisite:* MOLB 3000 or 3610 or 4600. (Normally offered fall and spring semesters).

5052. Summer Seminar. 1 (Max. 5). Consists of one week of lectures, presented by a renowned scientist from either academics or industry. The material presented is taken from the research program of the speaker. S/U Only. Dual listed with MOLB 4052.

5260. Quantitative Microscopy. 1. Acquaints students with principles of light microscopy, use of fluorescent probes and image processing software. Students use phase contrast, fluorescent, and confocal microscopes learning to measure and compare size and intensity of images. Dual listed with MOLB 4260. *Prerequisite:* MOLB 4600 or LIFE 3600, and PHYS 1120.

5400. Immunology. 4. Biology of immune system; cellular and molecular mechanisms; host resistance to infectious agents; as well as hypersensitivities, autoimmunity, tumor and tissue rejection. Includes laboratory for immunological techniques. Cross listed with PATB 4400. Dual listed with MOLB 4400. *Prerequisite:* PATB 2220. (Normally offered fall semester)

5440. Microbial Genetics. 3. Discusses microbial genetic approaches to study cell function and provides a molecular foundation for understanding how genes work to elicit phenotypes. Dual listed with MOLB 4440; Cross-listed with MICR 4440. *Prerequisites:* MOLB 2021 and 3000 and LIFE 3050. (Normally offered spring semester)

5450. Cell and Developmental Genetics. 3. Integrates the genetic control of cell regulation and animal development in both vertebrate and invertebrate model systems such as Dro-

sophila, *C. elegans* and the mouse. Includes studies of eukaryotic signal transduction, gene control, and current transgenic technologies. Dual listed with MOLB 4450. *Prerequisites:* MOLB 3000 and MOLB 4600 and LIFE 3050.

5460. Microbial Physiology and Metabolism I. 3. Studies life processes of microbes as mediated by their structures acting in consort, in response to changing environments. Dual listed with MOLB 4460. *Prerequisites:* MOLB 2021 or MOLB 2240 or MICR 2021 or MICR 2240, and MOLB 3610 or MOLB 4610. (Normally offered fall semester.)

5485. Computers in Biology. 1. Prepares students to use existing internet resources as research tools in biology without the need to write or install software. Topics include literature searching, multiple sequence alignment and phylogenetic tree construction, primer design, protein homology modeling, and the use of model organism databases. Dual listed with MOLB 4485. *Prerequisites:* MOLB 3000, 3610 or 4610, or LIFE 3600.

5495. Bioinformatics. 3. Topics range from classic algorithms in bioinformatics like multiple sequence alignment and phylogenetic tree construction to problems of functional analysis, including computational genomics, gene expression, protein structure, and systems biology analyses. Dual listed with MOLB 4495. *Prerequisite:* MOLB 3000 or 3610 or 4610 (MOLB 3610 or 4610 could be taken concurrently with MOLB 5495). Graduate standing.

5520. Molecular and Cellular Life Sciences Laboratory Rotations. 3 (Max. 6). Laboratory research rotations for first year Molecular and Cellular Life Sciences (MCLS) students in the doctoral program. *Prerequisite:* Enrollment in the Molecular and Cellular Life Sciences (MCLS) program.

5521. Molecular and Cellular Life Sciences Cornerstone. 1. Introduction for students in the Molecular and Cellular Life Sciences program to graduate school and research. Exposes students to diverse faculty research programs and elements fundamental to successful graduate and scientific careers, including scientific publishing, grants, careers, intellectual property, and ethical expectations. Offered Satisfactory/Unsatisfactory only. *Prerequisite:* Enrollment in the Molecular and Cellular Life Sciences doctoral program. (Normally offered fall semester)

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 ECOL 5540; Dual listed with MOLB 4540. *Prerequisite:* MOLB 2021.

5600. Biochemistry 1: Biomolecules. 3. Discussion of the structure and function of major biomolecules, including proteins, carbohydrates, nucleic acids and lipids, will provide the foundation for understanding biochemical, molecular and cellular processes. Dual listed with MOLB 4600. *Prerequisites:* consent of instructor. (Normally offered spring semester)

5610. Biochemistry 2: Bioenergetics & Metabolism. 3. Energy transduction and the central biochemical processes are discussed with an emphasis on regulatory controls and integration in metabolism. Dual listed with MOLB 4610. *Prerequisite:* consent of instructor. (Normally offered fall semester)

5615. Biochemistry 3: Molecular Mechanisms. 3. Biochemical and molecular mechanisms underlying cell function, including gene expression and epigenetic regulation, RNA and protein modification and function, assembly of macromolecular complexes, signaling and regulation of the cell cycle, are discussed. Dual listed with MOLB 4615. *Prerequisites:* consent of instructor. (Normally offered spring semester)

5630. Advanced Topics in Molecular Biology. 1-3 (Max. 6). Lectures, literature reviews and discussion of selected current topics in molecular biology. Check class schedule for current offerings each semester. *Prerequisites:* MOLB 3000 or 3610 or 4600.

5650. Protein Structure and Function. 3. Designed to provide an in-depth look at proteins and their structure. Topics will include protein purification, structure analysis, folding, modification, interactions with other molecules, enzyme mechanism, and other current topics. *Prerequisite:* MOLB 4610.

5670. Advanced Molecular Cell Biology. 3. Key concepts in eukaryotic cell biology will be presented with a focus on cellular processes that form the basis for human diseases. Cellular organization, dynamics, and signaling will be emphasized. Students will also explore principles of research design by critical reading and discussion of scientific literature. Dual listed with MOLB 4670. *Prerequisites:* MOLB 3000 or 3610 or 4610.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisites:* graduate standing and consent of instructor.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1 - 12. (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. 1-12 (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 degree program.

5990. Internship. 1 - 12 (Max. 24). *Prerequisite:* graduate standing.

Department of Plant Sciences

50 Agriculture Building, (307) 766-3103
FAX: (307) 766-5549

Web site: www.uwyo.edu/plantsciences
Department Head: Jim J. Heitholt

Professor:

JIM HEITHOLT, B.S. Western Illinois University 1978; M.S. University of Missouri 1980; Ph.D. University of Kentucky 1984; Professor of Crop Physiology 2014.

Associate Professors:

M. ANOWARUL ISLAM, B.S. Bangladesh Agricultural University 1990; M.S. Institute of Postgraduate Studies in Agriculture, Bangladesh 1996; Ph.D. University of Sydney, Australia 2003; Associate Professor of Forage Agronomy 2015, 2008.

ANDREW R. KNISS, B.S. University of Wyoming 2001; M.S. University of Nebraska-Lincoln 2003; Ph.D. University of Wyoming 2006; Associate Professor of Weed Ecology and Management in Cropping Systems 2013, 2007.

BRIAN A. MEALOR, B.S. North Georgia College and State University 1999; M.S. University of Wyoming 2003; Ph.D. 2006; Director, Sheridan Research and Extension Center; Associate Professor of Rangeland Restoration and Weed Science 2015, 2009.

URSZULA NORTON, B.S. Warsaw Agricultural University 1998; M.S. 1990; M.S. Iowa State University 1995; Ph.D. University of Montana 2000; Associate Professor of Agroecology and Soil Science 2015, 2009.

Assistant Professors:

SADANAND DHEKNEY, B.S. Mahatma Phule Agricultural University India 1997; M.S. Tamil Nadu Agricultural University India 1999; Ph.D. University of Florida 2004; Assistant Professor of Horticulture 2012.

CARRIE EBERLE, B.S. University of Wisconsin-Madison 2005; Ph.D. University of Minnesota 2012; Assistant Professor of Agronomy and Cropping Systems 2016.

RANDA JABBOUR, B.S. Rochester Institute of Technology 2003; Ph.D. Pennsylvania State University 2009; Assistant Professor of Agroecology 2013.

GUSTAVO SBATELLA, B.S. Universidad Nacional de Buenos Aires, Argentina 1990; M.S. University of Wyoming 2004; Ph.D. 2006; Assistant Professor of Irrigated Crops and Weed Management 2014.

VIVEK SHARMA, B.Tech. Punjab Agricultural University India 2008; M.S. University of Nebraska-Lincoln 2011; Ph.D. 2014; Assistant Professor of Agronomy/Irrigation Specialist 2016.

WILLIAM STUMP, B.S. Purdue University 1981; M.S. Colorado State University 1984; B.F.A. 1991; Ph.D. 1997; Assistant Professor of Plant Pathology 2014.

DAN TEKIELA, B.S. University of Illinois 2011; Ph.D. Virginia Tech University 2016; Assistant Professor of Invasive Plant Ecology and Management 2016.

Academic Professionals:

BETH FOWERS, A.S. College of Southern Idaho 2001; B.S. Utah State University 2007; M.S. 2011; Ph.D. University of Wyoming 2015; Assistant Research Scientist 2015.

CHRIS HILGERT, B.S. Oregon State University 2001; M.S. 2003; Extension Horticulture Specialist, Master Gardener Coordinator 2011.

KAREN PANTER, B.S. Colorado State University 1979; M.S. University of Nebraska 1981; Ph.D. Colorado State University 1985; Extension Horticulture Specialist 1998; Senior Extension Educator 2012.

MATT WALLHEAD, A.S. Ohio State University 2005; B.S. 2007; M.S. 2012; Ph.D. University of New Hampshire 2012; Assistant Research Scientist 2015.

Adjunct Professors:

Axel Garcia y Garcia, Stephen K. Herbert, Abdel Mesbah, Augustine Obour

Emeritus/Retired Faculty:

Rollin H. Abernethy, Jack Cecil, James Cook, Ron Delaney, Mark Ferrell, Alan Gray, Robin W. Groose, David Koch, Bernie Kolp, James M. Krall, Stephen D. Miller, Thomas D. Whitson, David Wilson

The Department of Plant Sciences offers a Bachelor of Science degree in Agroecology jointly with the Ecosystem Science and Management Resources, and three minors. Minors offered by Plant Sciences include Agroecology, Horticulture, and Plant Protection. The minor in horticulture includes courses in landscape design, plant materials and their propagation, organic food production, turfgrass science, and greenhouse design and management. The minor in Plant Protection includes courses in agronomy, plant genetics, plant pathology, and weed science. These minors allow students within many bachelors programs to obtain an added emphasis in areas that enjoy strong employment opportunities.

Agroecology Program

Rooms 50/2013 Agriculture Building

Phone: (307) 766-3103/766-2263

Departments of Plant Sciences and Ecosystem Science and Management

The Bachelor of Science degree program in agroecology is an interdepartmental major involving faculty in the Departments of Plant Sciences and Ecosystem Science and Management. An agroecology minor is also available.

The goal of Agroecology is to promote the adoption of more sustainable agricultural practices in the United States and abroad. The program is intended to provide students with the following knowledge and skills.

- Writing, oral communication, and math skills sufficient for success as an agricultural professional or for admission to graduate study to a related graduate degree program.
- Sufficient knowledge of physics, chemistry, geology, cell biology, physiology, genetics, evolution, and ecology for participation in modern agriculture.
- Practical knowledge and skills that include using computer technology for writing and analyzing data, using geographical information systems, conducting chemical and biological analyses of soil and water, diagnosing plant health problems, identifying plants and insects, and the general practice of horticulture and agronomy.

Professors:

Jim J. Heitholt, Plant Sciences
Ann L. Hild, ESM
David E. Legg, ESM
Scott Miller, ESM
Larry C. Munn, ESM
K.J. Reddy, ESM
Scott R. Shaw, ESM
Peter D. Stahl, ESM
Dave Williams, ESM
Stephen E. Williams, ESM

Associate Professors:

Timothy Collier, ESM
Anowarul Islam, Plant Sciences
Andrew R. Kniss, Plant Sciences
Brian A. Mealor, Plant Sciences
Ursula Norton, Plant Sciences
Daniel J. Rodgers, ESM
James W. Waggoner, ESM

Assistant Professors:

Sadanand Dhekney, Plant Sciences
Carrie Eberle, Plant Sciences
Randa Jabbour, Plant Sciences
Gustavo Sbatella, Plant Sciences
Vivek Sharma, Plant Sciences
William Stump, Plant Sciences
Dan Tekiela, Plant Sciences

Academic Professionals:

Beth Fowers, Plant Sciences
Christ Hilgert, Plant Sciences
Karen Panter, Plant Sciences
Matt Wallhead, Plant Sciences

Agroecology Major

A B.S. degree in agroecology prepares students for careers in agriculture, natural resources, environmental and life sciences and for advanced graduate studies in specific subdisciplines within these areas. It is a broad, interdisciplinary, undergraduate curriculum that combines and integrates courses in the crop, horticulture, disease, weeds, soil, and insect sciences and is supported by a science-based curriculum and general education. Flexibility is built into the agroecology curriculum to readily accommodate students seeking to pursue an emphasis or obtain a minor in a specific discipline, to that end the breadth of the curriculum is balanced with greater depth in biology, chemistry, crop science, entomology, environmental studies, natural resource management, soil science, plant pathology, weed science, horticulture, turf management, pre-veterinary medicine, rangeland ecology and watershed management, animal science, microbiology, and molecular biology. A liberal number of electives permits design of a program that best meets individual career and

educational objectives. The agroecology program is well suited for students who possess a strong interest in, and an aptitude for, science, agriculture, the environment, life sciences, or natural resources.

The agroecology core curriculum is comprised of freshman through senior level courses that illustrate dynamic and complex interactions of plants, soils, and plant pests (diseases, insects, weeds) with the environment. Academic training is enhanced with experiential learning through research apprenticeships, internships, field studies, and special agroecology capstone courses. Special emphasis is given to development of critical thinking and communication skills, problem solving and application of science. It is an interdisciplinary program designed to prepare students for “real world” situations.

Agroecology B.S. degree recipients are prepared for careers with private and public institutions and agencies in such areas as: agricultural consulting, production or sales, research, product development, education, extension education, international programs, and scientific and technological support. These careers include but are not limited to: soil scientist, conservationist, entomologist, consultant, plant scientist, integrated pest management specialist, ecologist, research associate or technician, agronomist, biotechnician, and agroecologist. Degree recipients are also prepared for graduate education in biological and environmental sciences.

Course Requirements for Agroecology Majors

	Hrs.
Agroecology	22
AECL 1000, 3030, 4990, SOIL 2010, 4140, and 4 hrs from a combination of AECL 4920, 4930 or 4960	
Supporting Science Biology/Genetics ..	25-26
ENTO 1000 or 1001 or REWM 3020 or ANSC 1010, and AGECE 1010 or 1020 and LIFE 1010, 2023, 3400, and CHEM 1000, 2300	
Math/Statistics	7
MATH 1400, STAT 2050	
Communications	3
COJO 2010	
Agriculture Science Electives.....	9
Select 9 hours upper division from one of the following: animal science, botany, crop science/horticulture/plant pathology (PLNT), entomology, microbiology/molecular biology, pest science, rangeland ecology and watershed management, or soil science.	

Supporting Electives.....	9
Select 9 hours upper division from any of the following: agroecology, agricultural economics, animal science, biology, botany, chemistry, communications, crop science/horticulture, environment and natural resources, entomology, food science, geography and recreation, microbiology, molecular biology, rangeland ecology and watershed management, pathobiology, plant pathology, soil science or zoology.	
Additional University Studies.....	6-9
Electives (minimum).....	36-39
Total	120

Agroecology/Environment and Natural Resources Program

(ENR, Plant Sciences, and Ecosystem Science and Management)

Students with an especially strong interest in the environment and natural resources may choose to pursue the B.S. in agroecology/ENR. This degree is offered in conjunction with the School of Environment and Natural Resources. See the ENR Information and Advising Guide for details.

Agroecology Minor

(Plant Sciences & Ecosystem Science and Management)

Minimum requirements.....	20-21
AECL 1000; two of the following: SOIL 2010, LIFE 2023, AECL 3030, and 9 additional upper division hours from the following: ENTO, PLNT, and/or SOIL	

Plant Protection Minor

(Plant Sciences)

Minimum requirements.....	17
AECL 1000, AECL 3030, and 10 additional hours from the following: PLNT 3220, 4000, 4070, and 4120.	

Horticultural Minor

(Plant Sciences)

Minimum requirements.....	16
PLNT 2025 and 2026, and 12 additional hours from the following: PLNT 3000, 3036, 3300, 3400, 4120, 4140, 4160, 4180, 4190, 4200, 4975.	

Graduate Study

The Department of Plant Sciences offers curricula leading to the master of science and doctor of philosophy degrees in Agronomy. Courses within the department are offered in crop science, horticulture, plant pathology, weed science, and agronomy. Interdisciplinary coursework and research projects are common for agronomy graduate students.

Program Specific Admission Requirements

In addition to university minimum requirements, a majority of the department faculty and department head must approve the admission. To be considered for admission, candidates must establish a faculty member willing to serve as advisor.

Program Specific Graduate Assistantship Information

M.S. assistantships include an \$12,078.00 stipend, plus tuition and fee waiver, and health insurance. Ph.D. assistantships include a \$16,785.00 stipend, plus tuition and fee waiver, and health benefits. These assistantships are for the 9 month academic year, but summer support is typically available.

Program Specific Degree Requirements

Master of Science in Agronomy

Plan A (thesis)

Requirements for the master of science degree include 26 hours of coursework numbered 4000 or above, 4 hours of thesis research, a research proposal, original research, and oral defense of the thesis.

The M.S. degree is typically completed in two years. The student's coursework is selected to fit the student's individual needs by mutual consultation among the student, his/her major professor and graduate committee.

Doctoral Program

The requirements for the doctor of philosophy degree include 60 hours of coursework numbered 4000 or above, 12 hours of dissertation research, a research proposal, original research, written and oral preliminary exams to be taken when most or all coursework is completed, and an oral defense of the dissertation.

Dissertations may be in a modified journal article format but must meet university formatting requirements.

The Ph.D. degree is typically completed in four years. The student's coursework is selected to fit the student's individual needs by mutual consultation among the student, his/her major professor and graduate committee.

The department does not require language certification.

The student is expected to participate in the usual activities of scientific research such as attending and presenting at research seminars and professional meetings and publishing his/her research.

Agroecology (AECL)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1000 [CROP/BOT 2000]. Agroecology. 4. [SB,G♦PN] Introduces ecological interactions that affect food producing (agricultural) systems. Lectures and laboratory exercises study the various biological components and the science of sustainable agricultural production. Features differences between developed and developing countries. Explores crises and challenges facing agriculture and global society.

2010. Introduction to Soil Science. 3. [SE♦♦(none)] Introduces soil ecological processes and management in terrestrial environments. Discusses interaction of soil, biological, chemical, morphological, and physical properties with land management in wildland and agricultural ecosystems. Emphasis of the course is on plant response to soil conditions. Cross listed with SOIL 2010. Prerequisite: 4 hours of chemistry.

3030 [2030]. Ecological Web: Ecology of Plant Protection. 3. Introduces students to concurrent evolution of crop cultivation and organisms, both plant and animal, that attack them. Provides basic skills necessary to understand ecology and management of economic crop pests. Prerequisites: LIFE 1010 and AECL 1000. (Offered fall semester)

4120. Organic Food Production. 3. A complete review of the federal organic production guidelines, methods and applications for organic production facilities, alternative marketing principles, concepts of organic fertilizer use, organic pest control and concepts for using environmentally friendly methods to reduce chemical, petroleum and synthetic inputs for more sustainable crop and livestock agricultural systems. Cross listed with PLNT 4120. Prerequisite: 8 hours of LIFE and/or CHEM. (Normally offered fall semester of odd-numbered years).

4130. Applied Remote Sensing for Agricultural Management. 3. Address principles and applications of remote sensing to crop and rangeland management. Provides an overview of remote sensing concepts and applications pertaining to crops, shrubs and range vegetation. In laboratory, students will learn to process remotely sensed data for mapping and monitoring crop and rangelands. Cross listed with RNEW/BOT 4130. Prerequisites: QA course and 9 credit hours in student's major field and junior/senior standing.

4400. Invasive Plant Ecology. 3. Ecological impacts of invasive, non-indigenous plant species, the ecological, genetic and evolutionary hypotheses for invasiveness, as well as management strategies for invasive plant species. Dual listed with AECL 5400; cross listed with RNEW 4400. Prerequisite: LIFE 3400.

4920 [CROP 4600]. Topics in Agroecology: Research Apprenticeship. 1-2 (Max. 4). Laboratory and/or field research apprenticeship. Emphasizes individual student-faculty interactions on current topics in agroecology. Prerequisite: AECL core courses.

4930 [CROP/ENTO/SOIL 4903]. Internship in Agroecology. 1-3 (Max. 6). Provides students with realistic views of crop science, entomology or soil science through practical, as well as work-related, experiences. Provides positive educational experience to supplement formal academic course work. Prerequisites: sophomore standing or higher; 2.5 GPA.

4960 [PLPA 4000]. Agroecology Field Studies. 2. Various facets of the agroecosystem are covered by visits to agricultural research stations, agri-businesses, private farms, national monuments, historical sites and Federal Parks. Students are exposed to ongoing sustainable research projects and innovative sustainable farming operations where a variety of cropping systems are utilized. Students are usually exposed to archaeological remains of ancient American Indian farming systems. An 8 day trip. Prerequisite: AECL 1000. (Offered as needed.)

4990. Agroecology Seminar. 3. [WC♦COM3] Capstone agroecology course for final integration of agroecology courses (AECL 2010, 3030, and LIFE 2023). Provides overall synthesis of these academic subjects following completion of a prescribed senior experience courses (AECL 4920 or 4930). (Offered spring semester)

5400. Invasive Plant Ecology. 3. Ecological impacts of invasive, non-indigenous plant species, the ecological, genetic and evolutionary hypotheses for invasiveness, as well as man-

agement strategies for invasive plant species. Dual listed with AECL 4400; cross listed with RNEW 5400. Prerequisite: LIFE 3400.

Plant Sciences (PLNT)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1101. First-Year Seminar. 3. [(none)♦FYS]
1150 [CROP 1150]. Pesticide Safety and Application. 1. Introduces various types and safe methods of pesticides application. Subsequent to completion, students may take the certification test administered by the Wyoming Department of Agriculture. Cross listed with ENTO 1150. Offered S/U only. (Normally offered during finals week of the fall semester)
2025. Horticultural Science. 3. [SB♦PN] Propagation, growth, development and utilization of horticultural plants. Students gain an understanding of plant classification, anatomy, interactions with the environment, production and utilization. Taught on-line only through Outreach. Prerequisites: AECL 1000 or LIFE 1010.

2026. Horticultural Sciences Laboratory. 1. [SB♦(none)] Offers hands-on experience in many areas of horticulture. Students learn basic horticultural plant structures and functions, propagation methods, growing media and fertilizers, landscaping, pruning, etc. Prerequisites: AECL 1000 or LIFE 1010. (Offered fall semester)

3000. Irrigated Agriculture. 3. Study of the complexity of plant/soil water relationships and its importance on irrigation. Soil and water relations, reference/crops evapotranspiration and management of the water balance. Principles of chemigation, computer modeling/monitoring included. Methods for irrigation scheduling and the importance of water use efficiency as a strategy for water conservation. Cross listed with SOIL 3000. Prerequisites: MATH 1400, SOIL 2010.

3036 [AECL 3036]. Grape Production. 3. Introduces students to the science of viticulture. Topics include grapevine origin and distribution, taxonomy, morphology and physiology, soil and climatic requirements, vineyard establishment, grapevine nutrition, cultural practices, harvesting and post-harvest management. Successful completion will enhance students' knowledge and understanding on grape production and management. Prerequisite: PLNT 2025.

3220 [PLPA 3220]. Plant Pathology. 3. Study of plant diseases, their causes, nature and control, as well as pathogen biology. Study of diseases caused by fungi, bacteria, vi-

ruses, nematodes, mycoplasma-like organisms, higher plants and abiotic factors on field and vegetable crops, as well as on landscape plants. Gives students insight into the impact plant diseases have on humans. *Prerequisite:* AECL 1000 or LIFE 1010. (Offered fall semester of odd-numbered years)

3300. Horticultural Plant Propagation. 3. Emphasis on sexual and asexual propagation of various plants including herbaceous and woody crops. Seed propagation discussions include anatomy, physiology, dormancy, and enhancing seed viability and germination. Asexual propagation discussions center on anatomy and physiology of cuttings, adventitious root formation, budding, grafting, and tissue culture. *Prerequisite:* AECL or PLNT 2025. (Normally offered spring semester of even-numbered years)

3400. Horticultural Plant Materials. 3. Examines horticultural tree, shrub, vine, and ground cover varieties, cultivars and native species of horticultural use. It includes herbaceous, woody, deciduous, evergreen, annual, biennial and perennial species. Common and specific names as well as pertinent facts on each species are correlated to field identification. *Prerequisite:* AECL/PLNT 2025 or LIFE 2023. (Offered fall semester of even-numbered years)

4000 [PLPA 4000]. Plant Disease Control. 3. Advanced study of plant diseases. Important diseases of field, forage and horticultural crops will be studied. Includes history and current distribution and uses of crops. Emphasis will be placed on pathogen biology and development of integrated disease management. Current and classic research papers on plant disease control will be discussed. Dual listed with PLNT 5000. *Prerequisite:* PLNT 3220. (Normally offered fall semester of even-numbered years)

4020. Sustainable Agriculture. 3. Focuses on the sustainability of agroecosystems and the human communities that maintain them in the context of regional, national, and global food and fiber requirements. Topics include the scale of agriculture, low-input systems, current energy and transportation challenges, markets, and integrated crop and livestock production. Dual listed with PLNT 5020. *Prerequisite:* 8 hours of biology. (Offered spring semester of even-numbered years)

4050. Plant Biotechnology. 3. Introduces students to the science and applications of plant cell, tissue and organ culture, and regeneration. Topics include in vitro techniques used for developing new genotypes. Successful completion will enhance knowledge and understanding of plant tissue culture techniques

and their applications in crop improvement. Dual listed with PLNT 5050. *Prerequisites:* LIFE 2023 or equivalent.

4070 [CROP 4070]. Weed Science and Technology. 4. Management and physiological principles involved in control of economically important farm and range weeds. Dual listed with PLNT 5070. *Prerequisite:* AECL 1000, LIFE 1010. (Normally offered fall semester)

4120. Organic Food Production. 3. A complete review of the federal organic production guidelines, methods and applications for organic production facilities, alternative marketing principles, concepts of organic fertilizer use, organic pest control and concepts for using environmentally friendly methods to reduce chemical, petroleum and synthetic inputs for more sustainable crop and livestock agricultural systems. Cross listed with AECL 4120. Dual listed with PLNT 5120. *Prerequisite:* 8 hours of LIFE and/or CHEM. (Normally offered fall semester of odd-numbered years).

4140. Turfgrass Science. 3. Turfgrass management practices from a plant biology perspective. Adaptability and maintenance of turfgrass species that are used in landscape and sports turf. Includes common, low maintenance, and intensively managed special sports turf species; sports turf construction techniques; establishment; fertility and integrated pest management. *Prerequisite:* AECL/PLNT 2025 or LIFE 2023. (Normally offered spring semester of odd-numbered years)

4160. Western Landscape Design. 4. Designed for the challenges and limitations of high altitude landscaping with an emphasis on water use efficiency. Primary course concepts include construction using hard materials, xeriscaping principles, decreased water consumption using specialized irrigation systems and selection of native, adapted species, as well as basic landscape design principles. *Prerequisite:* PLNT 3400. (Normally offered spring semester of odd-numbered years)

4180. Greenhouse Crop Production. 4. Production methods for a wide range of herbaceous plants including bedding plants, perennials, vegetables, flowering potted plants, and foliage plants. Emphasis is placed on current production techniques in controlled environments and in the field. Dual listed with PLNT 5180. *Prerequisite:* PLNT 3300. (Normally offered spring semester of odd-numbered years)

4190. Herbs, Spices and Medicinal Plants. 3. Includes the history and importance of herbs, spices, and medicinals; collection of these plants in the wild; botany; chemistry; greenhouse and field production; organic production; harvesting; drying; postharvest

operations; legal aspects; and products. Dual listed with PLNT 5190. *Prerequisites:* 8 hrs. LIFE and/or CHEM.

4200. Greenhouse Design and Management. 4. Emphasis on greenhouse structural and functional design concepts of economy, efficiency and energy conservation. Primary emphasis is on the limitations and advantages of greenhouses in the Rocky Mountain region, including alternative energy concepts. The management and operational concerns associated with private, commercial, educational and public greenhouses will be included. Dual listed with PLNT 5200. *Prerequisites:* PLNT 2025 and a USP QA/Q course.

4470 [CROP 4470]. Seed Science and Technology. 3. Presents aspects of seed biology and processing including development, physiology, ecology, germination, viability, dormancy, production, conditioning, storage, certification and marketing. Dual listed with PLNT 5470. *Prerequisite:* 8 hours of plant biology. (Normally offered fall semester of even years)

4520 [CROP 4520]. Plant Breeding. 3. Principles and methods for genetic improvement of all kinds of plants including agronomic, horticultural, forest and range species. Emphasizes fundamental concepts of quantitative genetics and integration of classical plant breeding with emergent biotechnology. *Prerequisites:* MATH 1000 or statistics course; LIFE 4000. (Normally offered fall semester of odd-numbered years)

4700 [CROP 2200, 3200; PLNT 3200]. Forage Crop Science. 3. The course focuses on major aspects of forage crop production and biology. Cultural practices, adaptation, sustainable agriculture and alternative use, seed production, harvest, livestock utilization and storage of forages. This course will have in-depth emphasis on characteristics of important grasses and legumes and utilization of forages for livestock production. Dual listed with PLNT 5700.

4790 [CROP 4700, 4790]. Topics: _____. 1-4 (Max. 10). Dual listed with PLNT 5790. *Prerequisite:* senior standing. (Offered based on sufficient demand and resources)

4900. Undergraduate Teaching Practicum. 1-2 (Max. 4). Supervised participation of undergraduates in the teaching of laboratory sections offered by the Department of Plant Sciences. Provides opportunity for students to gain teaching experience in agroecology, horticulture, or life science. *Prerequisites:* AECL 1000 and junior or senior standing.

4975. Problems in Plant Science. 1-2 (Max. 4). Provides an opportunity for students to conduct supervised research on specific topics of interest and importance in crop breeding,

genetics, physiology, pathology, ecology and pest management. *Prerequisites:* junior/senior standing with at least 10 hours of agroecology core requirements.

5000. Plant Disease Control. 3. Advanced study of plant diseases. Important diseases of field, forage and horticultural crops are studied. Includes history and current distribution of crops. Emphasis is placed on pathogen biology and development of integrated disease management. Current and classic research papers on plant disease control are discussed. Dual listed with PLNT 4000. *Prerequisite:* PLNT 3220.

5020. Sustainable Agriculture. 3. Focuses on the sustainability of agroecosystems and the human communities that maintain them in the context of regional, national and global food and fiber requirements. Topics include: the scale of agriculture, low-input systems, current energy and transportation challenges, markets, and integrated crop and livestock production. Dual listed with PLNT 4020. *Prerequisite:* 8 hours of Life Sciences.

5050. Plant Biotechnology. 3. Introduces students to the science and applications of plant cell, tissue and organ culture, and regeneration. Topics include in vitro techniques used for developing new genotypes. Successful completion will enhance knowledge and understanding of plant tissue culture techniques and their applications in crop improvement. Dual listed with PLNT 4050. *Prerequisites:* LIFE 2023 or equivalent.

5070. Weed Science and Technology. 4. Management and physiological principles involved in control of economically important farm and range weeds. Dual listed with PLNT 4070. *Prerequisite:* AECL 1000, LIFE 1010.

5120. Organic Food Production. 3. A complete review of the federal organic production guidelines, methods and applications for organic production facilities, alternative marketing principles, concepts of organic fertilizer use, organic pest control and concepts for using environmentally friendly methods to reduce chemical, petroleum and synthetic inputs for more sustainable crop and livestock agricultural systems. Dual listed with PLNT 4120. (Normally offered fall semester of odd-numbered years).

5180. Greenhouse Crop Production. 4. Production methods for a wide range of herbaceous plants including bedding plants, perennials, vegetables, flowering potted plants, and foliage plants. Emphasis is placed on current production techniques in controlled environments and in the field. Dual listed with PLNT 4180. *Prerequisite:* PLNT 3300.

5190. Herbs, Spices and Medicinal Plants. 3. Includes the history and importance of herbs, spices, and medicinals; collection of these plants in the wild; botany; chemistry; greenhouse and field production; organic production; harvesting; drying; postharvest operations; legal aspects; and products. Dual listed with PLNT 4190. *Prerequisites:* 8 hrs. LIFE and/or CHEM.

5200. Greenhouse Design and Management. 4. Emphasis on greenhouse structural and functional design concepts of economy, efficiency and energy conservation. Primary emphasis is on the limitations and advantages of greenhouses in the Rocky Mountain region, including alternative energy concepts. The management and operational concerns associated with private, commercial, educational and public greenhouses will be included.

5380. Crop and Weed Ecology. 4. Focuses on agroecosystems and the ecology of weeds. Main objective is to understand how ecological processes determine agroecosystem function and weed invasions. Some of the processes to be covered include: competition, succession, disturbance, nutrient cycling, diversity and evolution. *Prerequisites:* basic ecology course, senior standing with permission of instructor.

5410. Advanced Crop Physiology and Management. 3. Review and interpretation of current crop management and physiology literature. *Prerequisite:* 6 hours of biochemistry or plant physiology

5470. Seed Science and Technology. 3. Presents aspects of seed biology and processing including development, physiology, ecology, germination, viability, dormancy, production, conditioning, storage, certification and marketing. *Prerequisite:* 8 hours of plant biology.

5500. Clinical Plant Pathology. 2. Designed to give students practical experience in disease diagnosis. Students are exposed to a variety of current techniques used in the diagnosis and control of plant problems caused by abiotic and biotic factors. Primary emphasis is on the identification of biotic agents; including fungi, bacteria, nematodes and viruses. Students should gain experience and insight in the practical aspects of plant pathology. *Prerequisite:* PLNT 4000.

5600. Research in Crops. 1-4 (Max. 10). Investigation of research problems to include a written and oral presentation of results. *Prerequisite:* basic training in the field of problem selected.

5700. Forage Crop Science. 3. The course focuses on major aspects of forage crop production and biology. Cultural practices, adaptation, sustainable agriculture and alter-

native use, seed production, harvest, livestock utilization and storage of forages. This course will have in-depth emphasis on characteristics of important grasses and legumes and utilization of forages for livestock production. Dual listed with PLNT 4700.

5720. Plant Disease Problems. 1-3 (Max. 10). Biology, epidemiology, and control of specific crop, field and forage diseases. *Prerequisite:* PLNT 3220.

5790. Topics in Plant Sciences. 1-10 (Max. 10). Dual listed with PLNT 4790. *Prerequisite:* senior standing.

5820. Graduate Seminar. 1 (Max. 6). Discussion in production, physiology, breeding and weed science. *Prerequisite:* basic training in plant sciences.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate standing.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5960. Thesis Research. 1-12 (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. 1-12 (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.

Department of Veterinary Sciences

Wyoming State Veterinary Laboratory,
(307) 766-9925

FAX: (307) 721-2051

Web site: www.uwyo.edu/vetsci

email: vetscience@uwyo.edu

Department Head: William W. Laegreid

Professors:

HOLLY ERNEST, B.Sc. Cornell University 1980; M.S. Ohio State University 1982; D.V.M. 1986; Ph.D. University of California, Davis 2001; Professor of Veterinary Sciences, Wyoming Excellence Chair in Disease Ecology 2014.

FRANCIS D. GALEY, B.S. Colorado State University 1981; D.V.M. 1983; Ph.D. University of Illinois, Urbana-Champaign 1988; Professor of Veterinary Sciences 1999; Dean, College of Agriculture and Natural Resources, 2001.

WILLIAM W. LAEGREID, B.S. Washington State University 1980; M.S. Washington State University 1984; D.V.M. Washington State University 1985; Ph.D. Washington State University 1988; Professor, Head of the Department of Veterinary Sciences and Director of the Wyoming State Veterinary Laboratory 2012.

DONAL T. O'TOOLE, M.V.B. Trinity College, Dublin, Ireland 1977; Ph.D. Colorado State University 1982; Professor of Veterinary Sciences 1998, 1990.

Associate Professors:

GERARD P. ANDREWS, M.S. University of New Hampshire 1983; Ph.D. Uniformed Services University of Health Science 1993; Associate Professor of Veterinary Sciences 2011, 2004.

TODD E. CORNISH, B.S. University of California-Davis 1990; D.V.M. 1994; Ph.D. University of Georgia 1999; Associate Professor of Veterinary Sciences 2005, 1999.

JONATHAN H. FOX, B.Sc., B.VSc. University of Liverpool, UK 1993; Ph.D. Virginia Tech 2002; Associate Professor of Veterinary Sciences 2008, 2012.

Assistant Professors:

MYRNA M. MILLER, D.V.M. Colorado State University 1984; Ph.D. Cornell University 2005; Assistant Professor of Veterinary Sciences 2010.

JUAN F. MUÑOZ-GUTIÉRREZ, M.V.Z. College of Veterinary Medicine, National Autonomous University of Mexico 2006; Ph.D. Washington State University 2014; Assistant Professor of Veterinary Sciences 2015.

BRANT A. SCHUMAKER, D.V.M. University of California, Davis 2005; Ph.D. 2010; Assistant Professor of Veterinary Sciences 2010.

KERRY SONDEGROTH, B.A. University of New Hampshire 1997; D.V.M. Colorado State University 2006; Ph.D. Washington State University 2013; Assistant Professor of Veterinary Sciences 2014.

Adjunct Professors:

BARBARA S. DROLET, B.S. University of Wyoming 1986; M.S. 1989; Ph.D. Oregon State University 1994; Adjunct Professor of Veterinary Sciences 2002.

BRUCE R. HOAR, D.V.M. University of Saskatchewan 1985; M.S. 1996; Ph.D. University of California, Davis 2001; Adjunct Professor of Veterinary Sciences 2014.

GEOFFREY J. LETCHWORTH, B.S. Trinity College 1965; D.V.M. New York State College of Veterinary Medicine 1972; Ph.D. Cornell University 1980; Adjunct Professor of Veterinary Sciences 2001.

HERMANN SCHÄTZL, M.D. Max von Pettenkofer for Microbiology and Hygiene, Germany 1991; Wyoming Excellence Chair - Prion Biology 2010; Adjunct Professor of Veterinary Sciences 2012.

The Department of Veterinary Sciences and the Department of Animal Science have combined their efforts to offer B.S., M.S., and Ph.D. degrees in animal and veterinary science (see listing under this title). Several options within the major are available including preveterinary medicine and animal biology. Undergraduate course offerings of the Department of Veterinary Sciences are listed under the title of pathobiology. They were designed to familiarize students with the principles of animal disease and the basic biological and biomedical sciences.

The department operates the Wyoming State Veterinary Laboratory, an animal disease diagnostic laboratory (wyovet.uwyo.edu). This laboratory provides valuable hands-on experience for students interested in laboratory animal care, laboratory procedures, and research. Excellent faculty advisers are available for students interested in preveterinary medicine, microbiology, and animal biology.

Graduate Study

The Department of Veterinary Sciences offers advanced study leading to the master of science and doctor of philosophy in animal and veterinary science. Areas of emphasis include: pathology, molecular diagnostics, bacteriology,

virology, parasitology, epidemiology, immunology, and toxicology of wild and domestic animals.

Program Specific Admission Requirements

Open to students with a bachelor of science degree who meet the requirements set forth in this Catalog.

Recommended prerequisites include: chemistry, biochemistry, animal anatomy and physiology, biology, microbiology, and introductory statistics.

Program Specific Degree Requirements

Master of Science

Only offered as Plan A

A minimum of 30 credit hours including 4 thesis hours must be earned in 4000-5999 level courses.

Two semesters of graduate seminar (PATB 5515) and STAT (5050) or their equivalents are required.

The program of study is arranged with the student's graduate committee.

Doctoral Program

A 72 hour program.

Students must meet the university minimum requirements.

Preferred Requirements

Competitive applicants for either degree program will have a GPA 3.25 or higher and high GRE scores (153 verbal, 149 quantitative, 302 total using best composite scores).

Pathobiology (PATB)

USP Codes are listed in brackets by the 2003 USP code followed by the 2015 USP code (e.g. [QB♦Q]).

1001. Discovering Careers in Veterinary Medicine. 1. [I,L♦(none)] Career paths open to veterinarians are diverse including private practice, clinical specialties, basic/applied sciences like environmental/public health, preventive medicine, military service, microbiology and research. Additional topics: veterinary college application process, financing veterinary education, personal time /stress management of choosing a career in veterinary medicine and animal health.

1101. First-Year Seminar. 3. [(none)♦FYS]
2220. Pathogenic Microbiology. 4. Major communicable diseases of man caused by bacteria, mycoplasma. Discusses disease, di-

agnosis, treatment, prevention, and transmission. Cross listed with MICR 2220. *Prerequisite:* MICR 2210. (Offered spring semester)

4001. Epidemiology (Diseases in Population). 3. Basic epidemiologic concepts and approaches to population problems in medicine, with examples from veterinary and human health. Covers a wide spectrum of topics and introduces practical applications of epidemiology. Dual listed with PATB 5001; cross listed with MICR 4001. *Prerequisite:* STAT 2050 or STAT 2070.

4050. Problems in Animal Disease. 1-4 (Max. 6). Offers opportunity for supervised investigation of animal disease problems involving techniques of bacteriology, mycology, virology, gross pathology, histopathology and/or toxicology. *Prerequisites:* 12 semester hours of biological science and consent of instructor; MOLB 2021 is recommended for most students.

4100. Laboratory Animal Care and Management. 2. Informs junior, senior and graduate students of basic principles of care and management of the common laboratory animals used for research or as animal models of human disease. *Prerequisite:* 8 semester hours of biological science.

4110. Diseases of Food Animals. 3. Acquaints students with diseases of cattle, sheep, swine and poultry. Dual listed with PATB 5110. *Prerequisite:* LIFE 2022. (Normally offered spring semester)

4111. Equine Health and Disease. 3. To familiarize students with identification, prevention and treatment of diseases in horses through proper health management techniques. Dual listed with PATB 5111. Cross listed with ANSC 4111. *Prerequisites:* ANSC 1030, ANSC 3150.

4130. Mammalian Pathobiology. 3. [(none)▶▶COM3] Anatomical basis of disease in mammals. Emphasis on concepts of pathogenesis of disease, and the gross, microscopic and clinicopathological changes associated with lesions: cell injury and death; cellular degeneration; disturbances of growth and circulation; neoplasia; inflammation; and recognition of gross and microscopic tissue changes. Background in immunology will be beneficial. Dual listed with PATB 5130; cross listed with MICR 4130. *Prerequisite:* C or better in LIFE 2022. (Normally offered spring semester)

4140. Principles of Toxicology. 3. Toxicology is the study of poisons, their mechanisms of action and their effects on various organisms including man and domestic animals. Designed to provide students in the life and environmental sciences with an understanding

of the principles of toxicology as they apply to animal and human health, food safety and environmental studies. Dual listed with PATB 5140. *Prerequisite:* 9 hours of biological science (e.g., physiology), 4 hours chemistry, 3 hours biochemistry. (Normally offered fall semester of even-numbered years)

4150. Seminar. 1 (Max. 4). Preparation and oral presentation of papers on veterinary sciences topics. S/U Only. *Prerequisites:* 8 hours of biology and consent of instructor.

4170 [4120]. Diseases of Wildlife. 3. Introduction to wildlife diseases of the Rocky Mountain region and North America. Emphasis on infectious, parasitic, traumatic, toxic, and other disease agents with coverage of mechanisms of disease, epidemiology, and disease impacts on wildlife populations and species. Significant discussion of zoonotic diseases and diseases at the wildlife/domestic animal interface. Dual listed with PATB 5170. *Prerequisite:* 12 hours of biological or zoological sciences. (Offered spring semester of even-numbered years)

4200. Diagnostic Bacteriology. 1. Practical training with emphasis on diagnostic procedures used in a clinical microbiology laboratory. Students will identify bacterial pathogens of animals and humans. Taught in a clinical setting utilizing selected clinical material. Techniques employed in the processing and identification of clinically significant bacteria will be used and discussed. Safe laboratory practices for working with biohazards will be presented. Cross listed with MICR 4200. *Prerequisites:* junior standing and a microbiology course which included a laboratory.

4220. Molecular Mechanisms of Bacterial Pathogenesis. 3. Intended for students majoring in microbiology or a related field. The class will consist of lectures and small group decisions. Student responsibilities will include note-taking and preparation for discussion by completion of reading assignments consisting of classic and/or recent journal articles addressing the weekly topic. Cross listed with MICR 4220; dual listed with PATB 5220. *Prerequisites:* PATB/MICR 2220 and statistics (or epidemiology).

4240. Disease Ecology. 3. Introduction to 1) how interactions among species, ecosystems, human systems, and abiotic components of the environment affect patterns and processes of disease, and 2) considerations for coevolution of hosts and pathogens, conservation biology, models used to understand disease dynamics, and approaches to manage and control disease in animals, plants, and humans. Dual listed with PATB 5240. *Prerequisites:* LIFE 2022 or 2023 and STAT 2050 or 2070.

4310. Introduction to Veterinary Parasitology. 3. For animal science, zoology, biology or preveterinary majors. Discusses parasites of food producing and companion animals and uses preserved parasites in lecture and laboratory. *Prerequisite:* 8 hours of biological science. (Normally offered fall semester)

4320. Problems in Parasitology. 1-3 (Max. 5). Individual laboratory, library or field study of parasites and their host relations. *Prerequisites:* 8 semester hours of biological sciences or 3 semester hours of parasitology and consent of instructor.

4360. Medical Entomology and Parasitology. 4. Emphasis is on medically important arthropods, protozoa, and worms; clinical effects of infection, epidemiology, avoidance/control and identification/diagnosis. Cross listed with ENTO 4360; dual listed with PATB 5360. *Prerequisite:* 8 hours of biological science. (Normally offered fall semester of odd-numbered years)

4400. Immunology. 4. Biology of immune system; cellular and molecular mechanisms; host resistance to infectious agents; as well as hypersensitivities, autoimmunity, tumor and tissue rejection. Includes laboratory for immunological techniques. Cross listed with MOLB 4400. Dual listed with PATB 5400. (Normally offered spring semester)

4500. Veterinary Parasitology. 4. Biology, importance, diagnosis and control of helminth and protozoan parasites of wild and domestic animals. Arthropod vectors and/or intermediate hosts of helminth & protozoan parasites are included. Diagnostic procedures and identification familiarity with agents are emphasized in lab. *Prerequisite:* 8 hours of biological science. (Offered fall semester of even-numbered years)

4710. Medical Virology. 3. Human and animal viruses as biological entities. Methods of study, classification, replication strategies, diagnostic approaches, epidemiology and significance as disease agents. Dual listed with PATB 5710. Cross listed with MICR 4710. *Prerequisite:* MOLB 2240. (Normally offered fall semester)

5001. Epidemiology (Diseases in Population). 3. Basic epidemiologic concepts and approaches to population problems in medicine, with examples from veterinary and human health. Covers a wide spectrum of topics and introduces practical applications of epidemiology. Dual listed with PATB 4001; cross listed with MICR 5001. *Prerequisite:* STAT 2050.

5110. Diseases of Food Animals. 3. Acquaints students with diseases of cattle, sheep, swine and poultry. Dual listed with PATB 4110. *Prerequisite:* LIFE 2022. (Normally offered spring semester)

5111. Equine Health and Disease. 3. To familiarize students with identification, prevention and treatment of diseases in horses through proper health management techniques. Dual listed with PATB 4111. Cross listed with ANSC 5111. *Prerequisites:* ANSC 1030, ANSC 3150.

5120. Topics in Pathobiology. 1-4 (Max. 8). Lectures in current pathobiology topics derived from the expertise of the lecturer. *Prerequisite:* 12 hours of biological sciences and consent of instructor.

5130. Mammalian Pathobiology. 3. Anatomical basis of disease in mammals. Emphasis on concepts of pathogenesis of disease, and the gross, microscopic and clinicopathological changes associated with lesions: cell injury and death; cellular degeneration; disturbances of growth and circulation; neoplasia; inflammation; and recognition of gross and microscopic tissue changes. Background in immunology will be beneficial. Dual listed with PATB 4130. *Prerequisites:* C or better in LIFE 2022.

5140. Principles of Toxicology. 3. Toxicology is the study of poisons, their mechanisms of action, and their effects on various organisms including man and domestic animals. Designed to provide students in the life and environmental sciences with an understanding of the principles of toxicology as they apply to animal and human health, food safety and environmental studies. Dual listed with PATB 4140. *Prerequisite:* 9 hrs. biological science (eg. physiology), 4 hrs. chemistry, 3 hrs. biochemistry.

5160. Neurologic diseases: mechanisms and therapeutic approaches. 3. We will use lectures, student presentations and discussions to learn about impacts, molecular mechanisms and prospects for effective therapy of some important neurologic diseases of man and animals. Disorder we will study will include chronic traumatic encephalopathy, Alzheimer's disease, prion diseases, stroke and epilepsy. Cross listed with NEUR 5160. *Prerequisite:* Courses in neuroanatomy and biochemistry; graduate level standing. (Normally offered fall semester of odd-numbered years)

5170. Diseases of Wildlife. 3. Introduction to wildlife diseases of the Rocky Mountain region and North America. Emphasis on infectious, parasitic, traumatic, toxic, and other disease agents with coverage of mechanisms of disease, epidemiology, and disease impacts on wildlife populations and species. Significant discussion of zoonotic diseases and diseases at the wildlife/domestic animal interface. Dual listed with PATB 4170. *Prerequisites:* 12 hours of biological or zoological sciences.

5220. Molecular Mechanisms of Bacterial Pathogenesis. 3. Intended for students majoring in microbiology or a related field. The class consists of lectures and small group discussions. Student responsibilities will include note-taking and preparation for discussion by completion of reading assignments consisting of classic and/or recent journal articles addressing the weekly topic. Dual listed with PATB 4220; cross listed with MICR 5220. *Prerequisites:* PATB/MICR 2220 and statistics (or epidemiology).

5240. Disease Ecology. 3. Introduction to 1) how interactions among species, ecosystems, human systems, and abiotic components of the environment affect patterns and processes of disease, and 2) considerations for coevolution of hosts and pathogens, conservation biology, models used to understand disease dynamics, and approaches to manage and control disease in animals, plants, and humans. Dual listed with PATB 4240.

5360. Medical Entomology/Parasitology. 4. Emphasis is on medically important arthropods, protozoa and worms; clinical effects of infection, epidemiology, avoidance/control and identification/diagnosis. Dual listed with PATB 4360. *Prerequisite:* 8 hours of biological science.

5400. Immunology. 4. Biology of the immune system; cellular and molecular mechanisms; host resistance to infectious agents; as well as hypersensitivities, autoimmunity, tumor and tissue rejection. Includes laboratory for immunological techniques. Students are required to complete a term paper and make a presentation. Dual listed with PATB 4400; cross listed with MOLB 5400.

5500. Veterinary Parasitology. 4. Biology, importance, diagnosis and control of helminth and protozoan parasites of wild and domestic animals. Arthropod vectors and/or intermediate hosts of helminth & protozoan parasites are included. Diagnostic procedures and identificational familiarity with agents are emphasized in lab. *Prerequisite:* 8 hours of Biological Science.

5505. Investigations in Pathobiology. 1-4 (Max. 8). Research involvement in pathobiology to learn laboratory methods, scientific literature, research design and data analysis and presentation. *Prerequisite:* graduate standing and/or consent of instructor and 16 hours of biological sciences.

5510. Introductory Virology. 3. Prokaryotic and eukaryotic viruses as infectious agents and models for modern molecular biology. Examines concepts and principles of pathogenesis, host response and the regulation of virus-host

interactions. Genome organization, structure and replication will be examined within the context of the co-evolution of virus and host. Cross listed with MOLB 5510. *Prerequisite:* MOLB 3610 or 4600 plus 4610.

5515. Advanced Seminar in Pathobiology. 1 (Max. 4). Preparation and presentation of research topics in pathobiology with participation in discussions. *Prerequisite:* graduate standing and/or consent of instructor and 16 hours of biological sciences.

5710. Medical Virology. 3. Human and animal viruses as biological entities. Methods of study, classification, replication strategies, diagnostic approaches, epidemiology and significance as disease agents. Dual listed with PATB 4710.

5900. Practicum in College Teaching. 1-3 (Max. 3). Work in classroom with a major professor. Expected to give some lectures and gain classroom experience. *Prerequisite:* graduate status.

5920. Continuing Registration: On Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5940. Continuing Registration: Off Campus. 1-2 (Max. 16). *Prerequisite:* advanced degree candidacy.

5959. Enrichment Studies. 1-3 (Max. 99). Designed to provide an enrichment experience in a variety of topics. Note: credit in this course may not be included in a graduate program of study for degree purposes.

5960. Thesis Research. 1-12 (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. 1-12 (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.