College of Agriculture and Natural Resources

Frank Galey, Dean

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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
- 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
- Plant sciences
- Rangeland ecology and watershed management
- Rangeland ecology and watershed management/water resources
- Reproductive biology
- Soil science
- Soil science/water resources

Doctor of Philosophy

- Animal and veterinary science
- Entomology
- Molecular and cellular life sciences
- Molecular biology
- Plant sciences
- 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 devlopment 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/LTST/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. Dual listed with AGRI 5700. *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.

5700. 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. Dual listed with AGRI 4700. *Prerequisite:* Restricted enrollment. Prior approval required.

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

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Department Head: Benjamin S. Rashford

Professors:

CHRISTOPHER T. BASTIAN, B.S. University of Wyoming 1987; M.S. 1990; Ph.D. Colorado State University 2004; Professor of Agricultural Economics 2017, 2005.

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.

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.

KRISTIANA M. HANSEN, B.A. Reed College 1996; M.S. University of California, Davis 2003; Ph.D. 2008; Associate Professor of Agricultural Economics 2016, 2009.

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.

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 Professors:

VARDGES HOVHANNISYAN, B.S. Armenian State University of Economics 1999; M.S. Armenian State Agrarian University 2002; Ph.D. University of Wisconsin-Madison 2012; Assistant Professor of Agricultural Economics 2015.

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

Academic Professionals:

JEFFERSON G. EDGENS, B.A. Presbyterian College 1989; M.P.A. Coastal Management University of West Florida 1992; Ph.D. Michigan State University 1998; Senior Lecturer 2017; Dean, UW-Casper.

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.

SELENA GERACE, B.A. Whitman College 2007; M.S. University of Wyoming 2017; Assistant Extension Educator 2017.

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; Senior Exension Educator 1987.
BRIAN LEE, B.S. University of Wyoming 2010; M.S. 2012; Research Scientist 2012.
AMY NAGLER, B.A. University of Wyoming 1996; M.S. 2002; Assistant Research Scientist 2016.
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:
Nicole Ballenger, Edward Bradley, Larry J. Held, James J. Jacobs, Dale Menkhaus, 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.

The agricultural business curriculum is designed to enable our students to:

1. communicate effectively economic, agricultural, business decision-making and natural resource concepts,
2. fit into a business, agency, or academic environment and use economic concepts to quantify and analyze relevant issues, and
3. be familiar with issues related to agriculture, natural resources, and rural communities.

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 Option[1]

	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 either upper-division AGEC or business credit, but not both), 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***

[1]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.
[2]Recommend or equivalent COM1 course.
[3]Majors 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.
[4]MATH 2350 is required as of fall 2008.
[5]Credits earned in USP approved science courses offered within the College of Agriculture and Natural Resources shall also serve as Supporting Agriculture credits.
[6]H requirement cannot be fulfilled with AGEC or ECON courses; USP-approved H language courses are recommended.
[7]24 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.
[8]COSC 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 Option[1]

	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)	
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***

[1]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.
[2]Recommend or equivalent COM1 course.

[3]Major 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.

[4]MATH 2350 is required as of fall 2008.

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

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

[7]24 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.

[8]COSC 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 Option[1]

	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, AGEC 3860 or 4280 or 4460, and 6 hours of AGEC 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 AGEC 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***

[1]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.

[2]Recommended or equivalent COM1 course.

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

[4]MATH 2350 is required as of fall 2008.

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

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

[7]24 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.

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

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

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

[11]If a student wishes to use their elective hours to contribute to a minor in foreign language (18 hours beyond the 12 hours required), then 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

	Hrs.
First-Year Seminar (FYS)[1,2]	3
Writing - Communication[2,3]	9
COM1[2,3], COM2[2,3,4], COM3 - AGEC 4965 or AGEC 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
AGEC 1010, 1020, 2020, 4640, 3400 or 4710, 4060, 4050 or MKT 3210, AGEC 4830 or 4840[7], 4880 or 4280 or ECON 4720, AGEC 4500	
Additional Quantitative Skills	10
STAT 2050 or 2070[3]; COSC 1200 or IMGT 2400[8]; AGEC 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.

[1]Transfer 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 eared after high school, or 1 full year completed at another college (but less than 30 credits completed). COM3 automatically fulfills old I, L requirements.

[2]Must earn a "C" or better.

[3]Or equivalent course.

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

[5]PN and H may not be fulfilled by AGEC or ECON courses.

[6]18 hours of upper-division, not including AGEC 3020, 4965, or 4970. ECON 4720 can be counted towards these 18 hours.

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

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

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

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

[11]Courses 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. AGEC 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. AGEC 1010, 1020, 2020 and 4640; 9 additional hours in upper-level agricultural economics courses; 6 hours in supporting agriculture courses.

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

General Agricultural Economics Minor. AGEC 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 (22 hours).

Economic Theory

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

Quantitative Methods

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

Research

AGEC 5650 Communicating Research.....3
AGEC 5880 Advanced Seminar.....1

Plan A (thesis):

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

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

Achieve a cumulative 3.000 GPA in the AGEC 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 student's 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:

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

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

Management:
AGEC 4060, 4640 or 5460; or MGT 4410, 4420, 4440, 4470, or 4520
Marketing:
AGEC 4050, 4830, 4840, 4880, or 5710; or MKT 4240, 4430, 4520, or 4540
Finance:
AGEC 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 (AGEC 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 3.000 GPA in the AGEC 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 student's 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 3.000 GPA in the AGEC 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 student's graduate committee.

Graduate Minor in Applied Economics:

Graduate standing.

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

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

Agricultural Economics (AGEC)

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

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 spring 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:* AGEC 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:* AGEC/ECON 1020 and AGEC/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)

3420. Applied Equity Investing. 3. Introduces the fundamentals of understanding how the stock market works, what types of investment products are available, how to purchase them and what to look out for in making investment decisions. Students will make investment decisions on a simulated portfolio and write justifications for their purchases. *Prerequisite:* COM2 and MATH 1400. (Normally offered spring semester)

3750 [4750]. Natural Resource Planning and Economics. 3. Economic concepts and rudimentary analytical tools are applied to federal, state and local natural resource planning 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]. World Food, Ag, & Development. 3. [G◀▶H] Explores economic approaches to improving nutrition, agriculture production, and the environment in developing regions of the world. Students gain uinderstanding of complex conditions surrounding food security; institutions involved with food policy, aid, and production; environmental factors influencing agricultural production; inequality; and international cultural and so-

cietal food disparities. Cross listed with INST 3860. *Prerequisite:* AGEC/ECON 1010 or 1020. (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:* AGEC 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:* AGEC 1020 and MATH 1400. (Normally offered spring semester)

4070. Agricultural Sales. 3. Applies transactional analysis for understanding human behavior in agribusiness sales. Introduces experimental learning and fundamentals of agribusiness sales. *Prerequisites:* AGEC 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 AGEC 5200. *Prerequisites:* AGEC 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 AGEC 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 AGEC 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:* AGEC 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:* AGEC 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 AGEC 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 AGEC 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:* AGEC 1020, 2020 and MATH 1400. (Normally offered fall 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 AGEC 5660. *Prerequisites:* AGEC/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:* AGEC 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:* AGEC 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:* AGEC 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:* AGEC 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:* AGEC 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:* ECON 3020 and junior or senior standing. (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 AGEC 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 AGEC and approval of faculty supervisor.

4965. Agribusiness Entrepreneurship. 3. [WC◀▶COM3] Designed for students preparing to launch or work with an entrepreneurial venture. Students develop a business plan, synthesizing knowledge of agricultural economics, agribusiness management and finance, human resources and accounting. Emphasis is placed on advancing student professional communication abilities for agribusiness management careers. *Prerequisites:* senior standing, WB/COM2 writing course and AGEC 2020, or AGEC 4500, or AGEC 4060, or FIN 3250.

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 AGEC 4200. *Prerequisites:* AGEC 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 AGEC 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 AGEC 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 AGEC 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:* 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. Communicating Research. 3. Focuses on the broad methods, and written and oral communication of research in applied economics. Topics include formulating a research question, organizing a manuscript, editing for clarity and conciseness, building effective figures and tables, finding and citing literature, developing and delivering effective presentations, and upholding research ethics. *Prerequisites:* graduate standing.

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 AGEC 4660. *Prerequisite:* AGEC/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 AGEC 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 AGEC 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.

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, 2006.

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.

WHIT STEWART, B.S. Brigham Young University-Idaho 2008; M.S. Oregon State University 2010; Ph.D. New Mexico State University 2015; Assistant Professor of Animal Science 2017.

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, Richard J. McCormick, 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 changing 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 Quadrathalon 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, the Pre-vet Club, Wyoming Collegiate Cattlemens Association, and the Ranch Horse Team 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*; AGEC 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, 4120*, 4150, 4220, 4230 or 3150, 4540*, 4630* (COM3); PATB 4110*

Rangeland Ecology and Watershed Management .....
Required courses: REWM 2000, 2400, 4000, 4330; LIFE 3400

Agricultural Sciences .....
Required courses: FDSC 2040, 3060*; AGEC 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: AGEC 1010, 1020, 3860 or 4880; AGEC 4060 or MGT 3210; AGEC 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 1050, 1110, or 1120; ZOO/PSYC 3600; MATH 1400, 1405, or 1450; 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*, 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 thies 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 3060; 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 2.750 cumulative GPA and minimum 2.500 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 coursework-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)

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

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 3.000 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. (Normally offered spring semester)

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.

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 semester)

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.

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. (Normally offered spring semester)

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.

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 1030, 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 fall 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.

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; 2.500 GPA.

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.

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.

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. (Normally offered spring semester)

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.

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. (Normally offered spring semester)

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. (Normally offered fall semester)

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. (Normally offered fall semester)

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 fall 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). P*rerequisite:* 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.

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:* CHEM 1000 and LIFE 1010. (Normally offered fall semester)

3061. Livestock Slaughter Practicum. 1. Students learn and practice proper techniques of livestock slaughter. *Prerequisite:* FDSC 3060 or concurrent enrollment. (Normally offered fall semester)

3062. Carcass Fabrication. 1. Principles of carcass fabrication; Institutional Meat Purchase Specifications and North American Meat Processors nomenclature and fabrication procedures. *Prerequisite:* FDSC 3060 or concurrent enrollment. (Normally offered spring semester)

3063. Meat Processing. 2. Principles of applicable meat protein chemistry, heat transfer and other processing parameters applicable to production of sausage, cured meat, and other processed products. A variety of processed meat products will be manufactured in lab. *Prerequisite:* FDSC 3060 or concurrent registration. (Normally offered spring semester)

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. (Normally offered fall semester)

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 spring 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.

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. (Normally offered spring semester)

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

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. (Normally offered spring semester)

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 pro-

teins, 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 advanced 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: uwyo.edu/esm
Department Head: Scott N. Miller

Professors:

ALEXANDRE V. LATCHININSKY, B.S. St. Petersburg State University (Russia) 1979; M.S. 1980; Ph.D. University of Wyoming 2001; Professor of Entomology 2017, 2003.

SCOTT N. MILLER, B.S. Brown University 1991; M.S. University of Arizona 1995; Ph.D. 2002; Professor of Rangeland Ecology and Watershed Management 2017, 2002.

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.

KRISTINA HUFFORD, B.A. University of California-Berkeley 1993; Ph.D. University of Georgia 2001; Associate Professor of Rangeland Ecology and Watershed Management 2017, 2010.

THIJS KELLENERS, B.S. Wageningen University, The Netherlands 1988; M.S. 1993; Ph.D. 2001. Associate Professor of Soil Science 2012.

MELANIE MURPHY, B.S. University of Idaho 1998; M.S. 2001; Ph.D. Washington State University 2008; Associate Professor of Rangeland Ecology and Watershed Management 2017, 2010.

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.

Assistant Professors:

FABIAN NIPPGEN, M.S. Albert-Ludwigs University 2007; Ph.D. Montana State University 2014; Assistant Professor of Rangeland Ecology and Watershed Management 2017.

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 IJselland, Deventer 1999; M.S. Wageningen University 2002; Ph.D. Michigan Technological University 2008; Assistant 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; Research Scientist, Stable Isotope Facility Manager.

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

CALVIN STROM, Research Scientist 2010.

Adjunct Professors:

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

Professors Emeriti:

Ann Hild, William Laycock, David Legg, Larry Munn, Richard Olson, Katta Reddy, J. Daniel Rodgers, Quentin Skinner, Michael Smith, George Vance, James Waggoner, 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, hydrometorology, land-atmosphere interactions, eco-hydrology, hydrogeology, vadose zone hydrology, hydrologic applications of stable isotopes, limnology, hydrologic modeling, hydological 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 AGEC 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 AGEC, 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 AGEC.
- 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 certificate 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. [QB◀▶Q]).

1000. Wyoming Wildlands: Science and Stewardship. 3. [(none)◀▶PN] Introduces students to the breadth of Wyoming natural resources and ecosystems. In this class we investigate the science and management of the Wyoming landscape. Students are introduced to the rangelands, wildlife, forests, watersheds, and disturbed lands of Wyoming with an emphasis on understanding the ecology and natural history of the region. Throughout the course, students are exposed to how the extensive ecosystems of the West are managed by public and private groups and how human decisions change the landscape.

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

4800. Undergraduate Research. 1-3 (Max. 18). Undergraduate student research can be an important component in the intellectual and professional development of future scientists and land managers. Undergraduate students working with a faculty member in a research capacity can register for up to 3 credit hours per semester. The student and faculty member will identify an academic outcome that is associated with their research effort, such as a research paper, oral presentation, or poster session at an appropriate venue. Instructor's permission required.

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 Environment 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◀▶PN] 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. 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 in also examined. Covers population dynamics, predator-prey and insect-plant interactions, biological control and integrated pest management. *Prerequisite:* ENTO 1000 or LIFE 1003 or LIFE 1020 or consent of instructor.

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.

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 that 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 physiol-

ogy, 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. *Prerequisite:* 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	33
2000*, 2400*, 3000*, 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]).

1070. World Water Quality. 3. This course covers global water resources, fresh water demands, water quality issues, and water resources management on a watershed scale. Students become more knowledgeable about significance of availability and sustainability of water resources and water quality.

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.

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. 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.

4100. Nutritional Ecological Management of Range Herbivores. 3. Examines ecological processes and management of nutritional resources by domestic and wild rangeland herbivores. Topics include nutrient availability, nutritional demand, foraging behavior, diet composition, grazing systems, stocking rates, livestock/wildlife competition, predation, parasitism, plant toxicity, and influences on ecological condition. Students evaluate case studies and analyze nutritional data using current technologies. Dual listed with REWM 5100. *Prerequisite:* LIFE 1010 or LIFE 1020.

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)

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. 4. Assessment, monitoring, and analysis of rangeland ecosystems and proesses. 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. REWM students will be given enrollment preference. *Prerequisites:* REWM 2400 and STAT 2050 or STAT 2070. Concurrent enrollment in REWM 2400 and STAT 2050 or STAT 2070 is allowed with permission. (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)

4440. Applied Fire Ecology. 3. Course examines drivers and patterns of wildfire in rangeland and forested ecosystems, fire behavior, fuel characteristics, fire effects, suppression tactics and mitigation strategies, prescribed burning precautions and applications, applications/uses of fire to meet resource objectives, policies and regulations, and modeling software. Required field trips out of class time. Junior standing or greater class standing required. Dual listed with REWM 5440. *Prerequisite:* General biology and MATH 1400 or above.

4500. Rainfall-Runoff Modeling. 3. Introduction to hydrologic modeling that teaches the foundations of model development, calibration, and interpretation. Examins the different components of the water cycle and how they are being integrated into watershed models. Equips the students with the necessary skills to parameterize hydrologic models, understand the underlying principles, and interpret model outputs. Dual listed with REWM 5500. *Prerequisite:* REWM 4285.

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.

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.

4810. Experiments in Restoration. 2. Emphasis on the experimental design using examples from restoration science. Focus on experiments to test concepts in ecosystem science, food webs, population genetics, metapopulation biology, biodiversity and invasion, and climate change. Address topics in experimental, ecological restoration. Dual listed with REWM 5810. *Prerequisite:* STAT 2050 or equivalent.

4830. Ecological Applications for Wildland Management. 3. [WB◆▶(none)] Emphasis on applying understanding of intereactions among components of rangelands to facilitate sustainable provision of ecosystem services. The influences of stocasticity 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 AGEC 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.

5100. Nutritional Ecological Management of Range Herbivores. 3. Examines ecological processes and management of nutritional resources by domestic and wild rangeland herbivores. Topics include nutrient availability, nutritional demand, foraging behavior, diet composition, grazing systems, stocking rates, livestock/wildlife competition, predation, parasitism, plant toxicity, and influences on ecological condition. Students evaluate case studies and analyze nutritional data using current technologies. Dual listed with REWM 4100.

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.

5440. Applied Fire Ecology. 3. Course examines drivers and patterns of wildfire in rangeland and forested ecosystems, fire behavior, fuel characteristics, fire effects, suppression tactics and mitigation strategies, prescribed burning precautions and applications, applications/uses of fire to meet resource objectives, policies and regulations, and modeling software. Required field trips out of class time. Dual listed with REWM 4440. *Prerequisite:* graduate standing.

5500. Rainfall-Runoff Modeling. 3. Introduction to hydrologic modeling that teaches the foundations of model development, calibration, and interpretation. Examins the different components of the water cycle and how they are being integrated into watershed models. Equips the students with the necessary skills to parameterize hydrologic models, understand the underlying principles, and interpret model outputs. Dual listed with REWM 4500. *Prerequisite:* REWM 5285.

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.

5680. Landscape Genetics. 3-4. Provides a unique opportunity for interdisciplinary training and international collaboration uniting some of the most active landscape genetics groups in North America and Europe. A key objective of landscape genetics is to study how landscape modification and habitat fragmentation affect organism dispersal and gene flow across the landscape. Meeting this and other landscape genetic objectives requires highly interdisciplinary specialized skills making intensive use of technical population genetic skills and spatial analysis tools (spatial statistics, GIS tools and remote sensing). To bring these diverse topics and skills together effectively, we are using a distributed model of teaching. Population genetics, spatial analysis/statistics, and previous experience in Rare all extremely useful but not required. Cross listed with: ECOL 5680.

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.

5810 [5800]. Experiments in Restoration. 2. Emphasis on the experimental design using examples from restoration science. Focus on experiments to test concepts in ecosystem science, food webs, population genetics, metapopulation biology, biodiversity and invasion, and climate change. Address topics in experimental, ecological restoration. Dual listed with REWM 4810. *Prerequisite:* graduate standing.

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.

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. [QB◀▶Q]).

2010. Introduction to Soil Science. 4. [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 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 or organic matter and the role of microorganisms in organic nutrient transformations, reactions, 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).

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 analy-

sis of DNA sequence data. Cross listed with MOLB/MICR 4540. Dual listed with MOLB/SOIL/ECOL 5540. *Prerequisites:* MOLB 2210.

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 Geostatics. 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.

5540. Microbial Diversity and Ecology. 4. Introduces the diversity and ecology of soil microbes through an integrated lecture and laboratory course. Emphasis on molecular approaches to analyzing microbial diversity and evolution, and student-directed experimental design. Provides a continuum of realistic research experiences in molecular microbial ecology, from field work to evolutionary analysis of DNA sequence data. Cross listed with MOLB/MICR/SOIL 4540. Dual listed with MOLB/ECOL 5540. *Prerequisites:* MOLB 2210.

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

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Interim Department Head: Christine Wade

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.
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; Professor of Human Nutrition and Food/Dietetics 2017, 2005.

Associate Professor:
CHRISTINE WADE, B.S. Willamette University 2001; M.S. University of Wyoming 2005; Ph.D. 2008; Associate Professor of Human Development and Family Sciences 2015, 2008

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.

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, Michael Liebman, Judith A. Powell, Rhoda Schantz, Virginia Vincenti, 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

Majors are required to pass all courses within the Department of Family and Consumer Sciences with a grade of C or above. 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 above after three attempts you could be dismissed from your family and consumer sciences major. Students enrolled in Family and Consumer Sciences minors are required to take all courses required for the minor for letter grade and complete each course with a grade of C or above.

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. 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 1165 Introduction to Fashion and Dress 3
FCSC 1180 Applied Design.....3
FCSC 2180 Housing.....3
FCSC 3171 Introduction to Textile Science..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 3.000 is required for program admission. Students must also have a grade point average of at least 3.000 in the following courses: CHEM 1020, CHEM 1030, ENGL 1010, FCSC 1141, FCSC 1150, FCSC 2141, 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 2141 Nutrition Controversies	2
MOLB 2021 General Microbiology	4
STAT 2050 Fundamentals of Statistics	4
Total	***14***

SOPHOMORE YEAR: Spring	**Hrs.**
CHEM 2300 Intro Organic Chemistry *or* CHEM 2420 Organic Chemistry I	4
FCSC 2200 Professionalism and Communication in FCSC	3
ZOO 3115 Human Systems Physiology	4
FCSC Core Elective I	3
Total	***14***

After admission into the DPND, students must complete the following course sequence and maintain an overall grade point average of 3.000. Failure to maintain a GPA of 3.000 could result in program probation and/or suspension.

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 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 2141 Nutrition Controversies	2
MOLB 2021 General Microbiology	4
STAT 2050 Fundamentals of Statistics	4
Total	***14***

SOPHOMORE YEAR: Spring	**Hrs.**
CHEM 2300 Intro Organic Chemistry *or* CHEM 2420 Organic Chemistry I	4
FCSC 2200 Professionalism and Communication in FCSC	3
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 premedicine 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
MOLB 2021 General Microbiology	4
STAT 2050 Fundamentals of Statistics	4
FCSC Core Elective I	3
Total	***15***

SOPHOMORE YEAR: Spring	Hrs.
CHEM 2440 Organic Chemistry II	4
FCSC 2200 Professionalism and Communication in FCSC	3
MATH 2200 Calculus I	4
ZOO 3115 Human Systems Physiology	4
Total	***15***

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.

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. Once a student has applied and their transcripts have been received, their application will be reviewed. Transcripts will not be analyzed prior to application. Applicants must also satisfactorily complete a mandatory security screen (background check). Applicants must have successfully completed the following courses prior to entry.

Required Courses <u>Before</u> 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 the University Studies Program (USP) PN requirements

Completion of a course that meets the University Studies Program (USP) V requirement

Required Courses <u>After</u> 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 1141 Principles of Nutrition	3
FCSC 2121 Child Development	4
FCSC 2131 Family Relations	3
FCSC 2133 Intimate Relationships	3
Total	***13***

JUNIOR YEAR: Spring **Hrs.**
EDEC 3000 Observing Young Children.....3
FCSC 2050 Safety, Nutrition and Health in Early Childhood Programs.....2
FCSC 3119 Parent Child Relationships 3
FCSC 3122 Adolescence.....3
Total ***11***

JUNIOR YEAR: Summer **Hrs.**
FCSC 2200 Professionalism and Communication in FCSC.....3
FCSC 3220 Multicultural Influences on Children and Families 3
Total ***6***

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 *or* FCSC 4112 Family Decision Making and Resource Management 3
ENGL 4010 Technical Writing in the Professions *or* 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 3171 Introduction to Textile Science..3
FCSC 4130 Internship in Child Development or 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.

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.

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

FRESHMAN YEAR: Spring **Hrs.**
USP PN Elective 3
USP V Elective 3
COJO 1030 Interpersonal Communication..3
SOC 1000 Sociological Principles 3
FCSC Core Elective I 3
Total ***15***

SOPHOMORE YEAR: Fall **Hrs.**
FCSC Core Elective II.....3
FCSC 2121 Child Development.....4
FCSC 2131 Family Relations.....3
Electives 6
Total ***16***

SOPHOMORE YEAR: Spring **Hrs.**
USP PN Elective 3
FCSC 2110 Fundamentals of Aging and Human Development.....3
FCSC 2133 Intimate Relationships 3
FCSC 2200 Professionalism and Communication in FCSC.....3
FCSC 3119 Parent Child Relationships 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 *or* 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 *or* FCSC 4130 Internship in Child Development *or* FCSC 4131 Administrative Internship in Child Development 8
Upper Division Elective.....3
Total ***14***
TOTAL MINIMUM CREDIT HOURS ***120***

HDFS Career Track for Family and Consumer Sciences Teacher Certification

A career track, leading to certification/licensure to teach Family and Consumer Sciences in secondary schools, is available for majors in the Human Development and Family Sciences (HDFS) concentration. This program is made possible through a partnership agreement with UW Family and Consumer Sciences, Colorado State University (CSU) Family and Consumer Sciences program and the CSU Center for Educator Preparation. While meeting the requirements for the HFDS concentration, students will use electives to obtain expertise in other FCS specializations needed to teach adolescents in Wyoming and other state secondary programs. As a senior, students will then take the remaining courses needed to meet Wyoming and Colorado certification/licensure requirements at CSU in Ft. Collins. In their last semester, Wyoming students may complete their student teaching requirements in Southern Wyoming FCS school classrooms with supervision by an FCS teacher educator. Students obtain expertise in areas needed to teach Family and Consumer Sciences in Wyoming and other state secondary school programs. Concurrent enrollment semesters will be required. By participating in this partnership, students earn dual bachelor's degrees—one from UW and one from CSU. Students must earn a minimum of 150 credit hours between the two programs (minimum of 120 at UW and a minimum of 30 at CSU) in order to be awarded a degree from each institution. In addition, students meet the re-

quirements to apply for certification/licensure in Wyoming and in Colorado. Both licenses are reciprocal in many other states.

Upon declaring this career track, students must satisfactorily complete a mandatory security screen (background check). Advising will provide careful attention to the uniqueness of individual student situations and academic choices.

Students must meet all entry requirements at UW and CSU. Students in the CSU licensure program are required to earn a C or above in all content courses and teacher licensing courses, and a passing score on the appropriate licensing exam. Therefore, a C or above must be earned in all courses and an overall 2.75 GPA to be transferred to CSU to fulfill their program requirements.

The following course sequence is recommended for FCSC majors in this program area:

FRESHMAN YEAR: Fall **Hrs.**
ENGL 1010 College Composition and Rhetoric *or* HP 1020 Honors Colloquium I 3
FCSC 1141 Principles of Nutrition....3
MATH 1400 College Algebra 3
PSYC 1000 General Psychology 3
USP First-Year Seminar....3
Total ***15***

FRESHMAN YEAR: Spring **Hrs.**
CHEM 1000 Introductory Chemistry *or* CHEM 1020 General Chemistry I 4
COJO 2010 Public Speaking 3
FCSC 1150 Scientific Study of Food....3
HIST 1211 U.S. to 1865 *or* HIST 1221 U.S. from 1865....3
SOC 1000 Sociological Principles 3
Total ***16***

SOPHOMORE YEAR: Fall **Hrs.**
FCSC 1180 Applied Design 3
FCSC 2121 Child Development....4
FCSC 2131 Family Relations 3
HLED 1006 Personal Health....3
STAT 2050 Fundamentals of Statistics *or* STAT 2070 Intro Statistics for Social Sciences 4
Total ***17***

SOPHOMORE YEAR: Spring **Hrs.**
USP PN Elective 4
FCSC 2110 Fundamentals of Aging and Human Development 3
FCSC 2133 Intimate Relationships 3
FCSC 2200 Professionalism and Communication in FCSC....3
FCSC 3119 Parent Child Relationships 3
Total ***16***

JUNIOR YEAR: Fall **Hrs.**
ECON 1010/AGEC 1010 Principles of Macroeconomics *or* ECON 1000 Global Economic Issues....3
EDST 2480 Diversity and Politics of Schooling 4
FCSC 3122 Adolescence....3
FCSC 3184 Foundations of Merchandising I *or* FCSC 4181 Global Textiles Marketplace 3
PHIL 1000 Introduction to Philosophy....3
Total ***17***

JUNIOR YEAR: Spring **Hrs.**
FCSC 2188 Interior Design I....3
FCSC 3220 Multicultural Influences on Children and Families 3
FCSC 4112 Family Decision Making and Resource Management 3
FCSC 4118 Family Policy 3
MUSC 1000 Introduction to Music *or* THEA 1000 Introduction to Theatre....3
Total ***15***

SENIOR YEAR: Fall **Hrs.**
FCSC 3110 Personal Finance....3
FCSC 4113 Consumer Issues....3
FCSC 4117 Understanding Community Leadership 3
FCSC 4125 Professional Practices in HDFS 3
ITEC 2360 Teaching with Technology 2
Total ***14***

SENIOR YEAR: Spring **Hrs.**
ENGL 4010 Technical Writing in the Professions 3
FCSC 4138 Family Stress and Coping....3
FCSC 4132 Internship in Human Development and Family Sciences *or* FCSC 4130 Internship in Child Development *or* FCSC 4131 Administrative Internship in Child Development 6
Total ***12***
TOTAL MINIMUM CREDIT HOURS ***121***

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 *or* ECON 1010 Principles of Macroeconomics....3
FCSC 1165 Introduction to Fashion and Dress 3
FCSC 1175 Design Communication 3
FCSC 2270 Advanced Apparel Construction 3
SOC 1000 Sociological Principles 3
Total ***15***

SOPHOMORE YEAR: Fall **Hrs.**
AGEC 1020 Principles of Microeconomics *or* ECON 1020 Principles of Microeconomics 3
CHEM 1000 Introductory Chemistry *or* CHEM 1020 General Chemistry I 4
FCSC 2180 Housing....3
POLS 1000 American & WY Government .3
PSYC 1000 General Psychology 3
Total ***16***

SOPHOMORE YEAR: Spring **Hrs.**
USP PN Elective 3
COSC 1200 Computer Information Systems 3
FCSC 1141 Principles of Nutrition *or* FCSC 1150 Scientific Study of Food....3
FCSC 2188 Interior Design I....3
FCSC 2200 Professionalism and Communication in FCSC....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

Required courses in the following minors in Family and Consumer Sciences must be taken for a letter grade and completed with a grade of C or above.

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. Students must take courses for letter grade and receive a grade of C or above in each course.

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. Students must take courses for letter grade and receive a grade of C or above in each course.

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. Students must take courses for letter grade and receive a grade of C or above in each course.

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 2141 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. Students must take courses for letter grade and receive a grade of C or above in each course.

Required Courses
FCSC 2188 Interior Design I.....3
FCSC 4188 Interior Design II.....3
FCSC 3171 Introductory Textile Science 3
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 24

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.

The Early Childhood Program Director's Certificate can be completed as a stand-alone certificate, simultaneously with the distance Professional Child Development undergraduate option or the on-campus Human Development and Family Sciences undergraduate option in Family and Consumer Sciences, or to complement other related degree programs. Courses satisfy certification requirements in many states. They also fit professional development for home providers and daycare professionals. This program is a Gainful Employment program. Please see the following link for information about Gainful Employment programs: http://www.uwyo.edu/sfa/gainful-employment/.

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.

The following courses are recommended for this certification. All courses must be taken for letter grade and completed with a grade of C or above.

Required Nutrition Course
FCSC 1141 Principles of Nutrition.....3

Required Early Childhood Program Administration Course
FCSC 4127 Directing Preschool and Daycare Programs.....3

Choose one of the following Uniqueness and Cultural Awaremess courses:
EDEC 5220 Children with Disabilities.....3
EDEC 5240 Evaluation of Young Children with Disabilities.....3
FCSC 3220 Multicultural Influences on Children and Families.....3
NURS 3020 Cultural Diversity in Family Health Care.....3
SOC 2350 Race and Ethnic Relations.....3

Choose one of the following Family Relationships courses:
FCSC 2131 Family Relationships.....3
FCSC 3119 Parent Child Relationships.....3
FCSC 4124 Families of Young Children with Special Needs.....3

Choose one of the following Early Childhood Growth and Development courses:
FCSC 2121 Child Development.....4
PSYC 2300 Developmental Psychology.....3
and
FCSC 2122 Child Development Lab.....1

Choose one of the following Health and Safety courses:
FCSC 2050 Safety, Nutrition and Health in Early Childhood Programs.....3
EDEC 4350 Health Management Issues in Early Education.....3

Choose nine credit hours from the following Early Childhood Methods and Techniques courses:
EDEC 3000 Observing Young Children.....3
EDEC 3210 Program and Curriculum Development for Young Children.....2-3
EDEC 3220 School Programs for Young Children.....3
EDEC 4320 Oral and Written Language Acquisition.....3
EDEC 5230 Curriculum and Materials for Young Children with Disabilities.....3
FCSC 4130 Internship in Child Development.....6-8
FCSC 4131 Administrative Internship in Child Development.....6-8

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 design, merchandising and textiles. 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 up on 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.

1165. Introduction to Fashion and Dress. 3. [(none)◀▶H] Course explores the system of dress, from body to garment selection, and the influences of psychology, culture and subculture on dress and self-presentation. Topics discussed include body image, society and social control, norms and dress outside the western world. Course will conclude by exploring current designers.

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 fall semester)

1175. Design Communication. 3. Explores philosophical and practical factors of the design communication process. Incorporates various methods of communicating design ideas and concepts from hand drawing and rendering to digital techniques through Adobe Creative Suite.

1180. Applied Design. 3. [CA◀▶H] A study of design principles and elements and their relation to the design of marketable consumer goods. Emphasizes developing creative thinking and proper fabrication techniques in solving both 2-D and 3-D design problems.

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 or EDST 2450.

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.

2141. Nutrition Controversies. 2. This course expands upon nutrition concepts covered in FCSC 1141 by exploring current nutrition-related controversies. Skills related to the interpretation of research literature will be emphasized. *Prerequisite:* FCSC 1141.

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; FCSC 1175. (Offered alternate fall semesters)

2180. Housing. 3. Cross-cultural examination of the evolution of contemporary housing, both as an artifact of material culture, and as the environmental setting which affects human development and interaction. Studies effective planning of residential spaces and neighborhoods, and the housing industry. Prerequisite: WA/COM1.

2188. Interior Design I. 3. Beginning interior design course. Helps students use design principles to solve design problems and create functional, sustainable, and aesthetically pleasing interior spaces. Emphasizes design development through hand drawing and rendering techniques. *Prerequisites:* FCSC 1180 and sophomore standing, or consent of instructor. (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 and approaches to problem solving using the body of knowledge in the field. The course will focus on professionalism and communication strategies using our departmental competencies. *Prerequisites:* FCSC major, FYS and COM1.

2270 [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. *Prerequisite:* FCSC 1170. (Offered spring semester)

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. Provides an overview of research and theory related to the processes of parent-child relationships across the lifespan. Emphasizes developmental and family theory and contexts that influence parent-child relationships. Introduces parent education as a method for applying parenting scholarship to professional practice. *Prerequisite:* PSYC 1000 or FCSC 2121 or EDST 2450.

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. 2. 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 1141; 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 1141; ZOO 3115.

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 laballing. *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)

3171 [2171]. Introductory Textile Science. 3. Understanding of textile fibers, their growth or manufacture, properties, use and care; conversion of fibers through yarn and fabric manufacturing systems. 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 merchandising, consumer behavior as it relates to promotion activities, and selling techniques including advertising, display, publicity, fashion shows, and special events. Students will be involved in actual hands-on experiences with several techniques. *Prerequisite:* FCSC 1180. (Offered fall semester odd years)

3174 [4170]. Flat Pattern Design. 3. Principles and instructions for drafting and hand grading patterns using slopers through standard or individual measurements. Techniques of garment design are learned to create three-dimensional designs using the flat pattern method. *Prerequisites:* FCSC 2175 and 3170. (Offered alternate spring semesters)

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. Planning, developing, and presenting product line(s) for identified target market(s) in relation to pricing, assortments, styling and timing. Concepts of supply chain business systems. *Prerequisite:* ECON 1010. (Offered every 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.

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.

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. Dual listed with FCSC 5112. *Prerequisites:* PSYC 1000 or SOC 1000 or COJO 1030 or 1040; WB/COM2.

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 comple-

tion. 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/COM2 course. (Offered fall semester)

4118. Family Policy. 3. Explores the relationships between public programs/policies/laws and family functioning. The roles of family professionals in advocacy and education regarding policies will be discussed. Attention will be paid to current events relevant to family policy issues and the policy process at the state level. Dual listed with FCSC 5118. *Prerequisites:* FCSC 2131; junior standing.

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 professional and ethical issues related to professional practice in Human Development and Family Sciences. Reviews Family Life Education history, purpose, and methodology. Emphasizes skills and knowledge needed to work in various settings with individuals and families across the lifespan. This class is a prerequisite for HDFS student internships (FCSC 4130; FCSC 4131; FCSC 4132). *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 childhood 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. (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 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. Printing and finishing techniques used for textiles. *Prerequisite:* FCSC 3171. (Offered fall semester)

4174. Foundations of Merchandising II. 3. A review of the fashion industry including types of fashion retail and the use of technology in retail sales. Exploration of merchandising/retailing principles, and the formulas and calculations essential to these principles. *Prerequisite:* MATH 1400.

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 2270 and FCSC 4171.

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 1165. (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 1165. (Offered spring semester odd years)

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/COM2 requirement. (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/LTST/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. *Prerequisite:* graduate standing.

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 and 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. *Prerequisite:* graduate standing. (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

107 Aven Nelson Building,
(307) 766-4158
FAX: (307)766-2380
Web site: www.uwyo.edu/lifescience
Program Director: Jonathan Prather

The Life Sciences Program consists of all LIFE prefix courses. These courses support a wide range of life science majors and several non-life science majors across campus. The number of LIFE courses taken by students in each major is determined by the departments that offer the majors. The curriculum intends to provide 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: gandrews@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
BERIT BANGOURA, Veterinary Sciences
BLEDAR BISHA, Animal Sciences
JASON GIGLEY, Molecular Biology
MARK GOMELSKY, Molecular Biology
MYRNA MILLER, Veterinary Sciences
BRANT SHUMAKER, Veterinary Sciences
KERRY SONDGEROTH, Veterinary Sciences
HOLLY STEINKRAUS, Molecular Biology
LINDA VAN DIEPEN, ESM
DANIEL WALL, Molecular Biology
RACHEL WATSON, Molecular Biology
JOHN WILLFORD, 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..... 124
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
PATB 4150, or MOLB 4050
(or MOLB 4051 or MOLB 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 4240 Disease Ecology.....3
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 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, Microbial Diversity and Ecology 4
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. 3. This course serves as an introduction to bacterial pathogenesis and disease using taxonomy and categorical approaches. Material presented in the course includes maintenance, transmission, molecular mechanisms of virulence factors, pathogen-host interactions, disease process, and treatment and prevention of disease of pathogenic bacteria and fungus. Cross listed with PATB 2220. *Prerequisite:* MOLB/MICR 2021.

2240. Medical Microbiology. 4. 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/MICR 2021.

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 clinicopatholigical 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 as a survey of the molecular mechanisms that have evolved in pathogenic bacterial species which result is disease. The broad-scoped objective is to assist students in gaining an understanding of principals and concepts as they apply to common themes of bacterial virulence acting on higher order host organisms. In-class review/discussion of scholarly manuscripts, historical to present day, is paramount in allowing students to gain a better appreciation and comprehension of biological principals and concepts through knowledge of experimental approaches. 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. 4. [(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:* Minimum grade of C- in MOLB/MICR 2021 or 2240 and MOLB 3610 or 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/SOIL 4540. Dual listed with MOLB/SOIL/ECOL 5540. *Prerequisite:* MOLB/MICR 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:* MICR/PATB 2220 or MOLB/MICR 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 as a survey of the molecular mechanisms that have evolved in pathogenic bacterial species which result is disease. The broad-scoped objective is to assist students in gaining an understanding of principals and concepts as they apply to common themes of bacterial virulence acting on higher order host organisms. In-class review/discussion of scholarly manuscripts, historical to present day, is paramount in allowing students to gain a better appreciation and comprehension of biological principals and concepts through knowledge of experimental approaches. 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

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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.

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.

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 Professor

ANNE W. SYLVESTER, B.S. University of Washington 1980; M.S. 1982; Ph.D. 1987; Professor of Molecular Biology 2010, 2006.

Professors Emeritus

Dale Isaak, Randy Lewis, Nancy Petersen, Don Roth, Mark M. Stayton, 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**
1. General Science Requirement		
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.

2. MOLB Core Requirement		
MOLB	3000	3
MOLB	4600 and 4610	6
MOLB	4320	4
MOLB	4485	1
MOLB	4050 and 4051 or 4052	2
	Total	***16***
3. MOLB Advanced Core Requirement		
MOLB	4440 or 4450 or 4670	3
	Total	***3***

4. MOLB Elective Requirement (9 hours)

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.

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 are not required but 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	3
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

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.**
CHEM	2440	4

JUNIOR YEAR: Fall		**Hrs.**
MOLB	4600	3
PHYS	1110	4
MOLB	4485	1
LIFE	3050	4

JUNIOR YEAR: Spring		**Hrs.**
MOLB	4610	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).

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 pursing 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.

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 pursing 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 eukryotic 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. Cross listed with MICR 2240. *Prerequisites:* LIFE 1010. (Normally offered spring semester.)

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. *Prerequisites:* LIFE 1010 and CHEM 1030; MOLB/MICR 2021 recommended. (Normally offered fall and summer semesters.)

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. *Prerequisites:* LIFE 1010 and a minimum grade of C- in CHEM 2300 or CHEM 2420. (Normally offered fall and some 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.

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.

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:* Minimum grade of C- in MOLB 3610 or 4600; course in physiology recommended (e.g. ZOO 3115). (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:* Minimum grade of C- in MOLB 3610 or MOLB 4600.

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:* MOLB/MICR 2021 or 2240 or PATB 2220, and a minimum grade of C- in MOLB 3000 or MOLB 3610. (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:* Minimum grade of C- in MOLB/MICR 2021 or 2240 and MOLB 3610 or 4610. (Normally offered fall semester)

4485. Computers in Biology. 1. Lectures and hands-on computational exercises in bioinformatics that prepare students to use a range of graphical and command-line tools to analyze genetic data efficiently at various scales. Exercises in several subdisciplines of bioinformatics are implemented in Linux on local workstations or remote servers. Dual listed with MOLB 5485. *Prerequisites:* Minimum grade of C- in MOLB 3000 or LIFE 3050. (Normally offered fall semester)

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/SOIL 4540. Dual listed with MOLB/SOIL/ECOL 5540. *Prerequisite:* MOLB 2021.

4600. Biochemistry 1: Bioenergetics and Metabolism. 3. Structure and function of major biomolecules, energy transduction, and central biochemical processes are discussed with an emphasis on regulatory controls in metabolism and cellular processes. Dual listed with MOLB 5600. *Prerequisites:* Minimum grade of C- in CHEM 2300 or CHEM 2420 and MOLB 3000 or MOLB 3610. (Normally offered fall semester)

4610. Biochemistry 2: 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 5610. *Prerequisite*: Minimum grade of C- in MOLB 3610 or MOLB 4600. (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 and MOLB 3610 or MOLB 4600.

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.

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.

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.

5055. Molecular Monday. 1 (Max. 12). Students will present and hear formal presentations of research being conducted at the University of Wyoming in the molecular biosciences. Participation in question and answer periods following presentations is required, as is the completion of an evaluation form for each presentation. *Prerequisite:* graduate standing.

5056. Current Topics in Cell Biology. 2 (Max. 18). Students present their ongoing laboratory research and receive feedback from lab group members. Principles of research design will be explored by critical reading and discussion of current topical literature. *Prerequisite:* graduate standing.

5057. Microbial and Synthetic Biol. 2 (Max. 18). Students will present current research in the fields of Molecular Microbiology and Synthetic Biology, which will be followed by a critical discussion moderated by the course instructors. Students will explore the principles of research design by critical reading and discussion of scientific literature. *Prerequisite:* graduate standing.

5058. Experimental Molec Genetics. 2 (Max. 18). Students will formally present their research on molecular biology projects and will actively participate in discussion of other student's presentations. Students will also select current topical research articles and present critical evaluations of those articles to the class. *Prerequisite:* graduate standing.

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:* MOLB/MICR 2021 or 2240 or PATB 2220, and a minimum grade of C- in MOLB 3000 or MOLB 3610. (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 Drosophila, 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*: Minimum grade of C- in MOLB/MICR 2021 or 2240 and MOLB 3610 or 4610. (Normally offered fall semester.)

5485. Computers in Biology. 1. Lectures and hands-on computational exercises in bioinformatics that prepare students to use a range of graphical and command-line tools to analyze genetic data efficiently at various scales. Exercises in several subdisciplines of bioinformatics are implemented in Linux on local workstations or remote servers. Dual listed with MOLB 4485. *Prerequisites:* Minimum grade of C- in MOLB 3000 or LIFE 3050. (Normally offered fall semester)

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 MOLB/MICR/SOIL 4540. Dual listed with SOIL/ECOL 5540. *Prerequisite:* MOLB 2021.

5600. Biochemistry 1: Bioenergetics and Metabolism. 3. Structure and function of major biomolecules, energy transduction, and central biochemical processes are discussed with an emphasis on regulatory controls in metabolism and cellular processes. Dual listed with MOLB 4600. *Prerequisites:* consent of instructor. (Normally offered fall semester)

5610. Biochemistry 2: 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 4610. *Prerequisite*: 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 and MOLB 3610 or MOLB 4600.

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-Madision 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.

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.

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

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
Scott Miller, ESM
Scott R. Shaw, ESM
Peter D. Stahl, ESM
Dave Williams, ESM
Stephen E. Williams, ESM

Associate Professors:

Timothy Collier, ESM
Sadanand Dhekney, Plant Sciences
Anowarul Islam, Plant Sciences
Andrew R. Kniss, Plant Sciences

Brian A. Mealor, Plant Sciences
Urszula Norton, Plant Sciences

Assistant Professors:
Carrie Eberle, Plant Sciences
Randa Jabbour, 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

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 AGEC 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.

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

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; 2.500 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 management 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. *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. *Prerequisites*: 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, viruses, 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. 3. 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. 3. 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 will 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 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 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

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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.

JONATHAN H. FOX, B.Sc., B.VSc. University of Liverpool, UK 1993; Ph.D. Virginia Tech 2002; Professor of Veterinary Sciences 2016, 2008.

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, B.S. Pennsylvania State University 1980; M.S. University of New Hampshire 1983; Ph.D. Uniformed Services University of Health Sciences 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.

MYRNA M. MILLER, B.S. Colorado State University 1980; D.V.M. 1984; Ph.D. Cornell University 2005; Associate Professor of Veterinary Sciences 2016, 2010.

BRANT A. SCHUMAKER, B.S. University of California-Davis 2001; D.V.M. 2005; Ph.D. 2010; Associate Professor of Veterinary Sciences 2016, 2010.

Assistant Professors:

BERIT BANGOURA, D.V.M. Leipzig University 2003; Ph.D. 2008; Ph.D. 2015; Diplomate EVPC 2014; Assistant Professor of Veterinary Sciences 2017.

KERRY SONDGEROTH, B.A. University of New Hampshire 1997; D.V.M. Colorado State University 2006; Ph.D. Washington State University 2013; Assisant Professor of Veterinary Sciences 2014.

Adjunct Professors:

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.

Professors Emeritus

E. Lee Belden, Bill Jolley, Merl Raisbeck, Lynn Woodard

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 3.250 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. 3. This course serves as an introduction to bacterial pathogenesis and disease using taxonomy and categorical approaches. Material presented in the course includes maintenance, transmission, molecular mechanisms of virulence factors, pathogen-host interactions, disease process, and treatment and prevention of disease of pathogenic bacteria and fungus. 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 clinicopatholigical 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 as a survey of the molecular mechanisms that have evolved in pathogenic bacterial species which result is disease. The broad-scoped objective is to assist students in gaining an understanding of principals and concepts as they apply to common themes of bacterial virulence acting on higher order host organisms. In-class review/discussion of scholarly manuscripts, historical to present day, is paramount in allowing students to gain a better appreciation and comprehension of biological principals and concepts through knowledge of experimental approaches. 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. Cross listed with ENR 4240. *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 anthropods, 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. *Prerequisites:* MOLB/MICR 2021 or 2240 or PATB 2220, and a minimum grade of C- in MOLB 3000 or MOLB 3610. (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 as a survey of the molecular mechanisms that have evolved in pathogenic bacterial species which result is disease. The broad-scoped objective is to assist students in gaining an understanding of principals and concepts as they apply to common themes of bacterial virulence acting on higher order host organisms. In-class review/discussion of scholarly manuscripts, historical to present day, is paramount in allowing students to gain a better appreciation and comprehension of biological principals and concepts through knowledge of experimental approaches. 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. Cross listed with ENR 5240.

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. *Prerequisites:* MOLB/MICR 2021 or 2240 or PATB 2220, and a minimum grade of C- in MOLB 3000 or MOLB 3610.

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. Exam-

ines 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.