

# Department of Animal, Dairy and Veterinary Sciences

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**Degrees offered:** Bachelor of Science (BS) in Animal Science, Dairy Science, Bioveterinary Science; Master of Science (MS) in Animal Science, Bioveterinary Science, Dairy Science; Doctor of Philosophy (PhD) in Animal Science and Bioveterinary Science; MS and PhD degrees in Toxicology are available through the Interdepartmental Toxicology program

**Undergraduate Emphases:** *Animal Science*—Animal Industries, Biotechnology, Science; *Dairy Science*—Dairy Industries, Science; *Bioveterinary Science*—Biotechnology

**Graduate Specializations:** *Animal/Dairy Science*—Animal Nutrition, Breeding and Genetics, Molecular Biology, Reproductive Biology, Animal or Dairy Management (MS only); *Bioveterinary Science (PhD only)*—Parasitology, Toxicology, Virology

**Certificate Program:** Dairy Herdsman

## **Undergraduate Programs**

### **Objectives**

Bachelor's degree students majoring in Animal Science may choose a program from three career emphasis areas: **Science, Animal Industries**, or **Biotechnology**. Students majoring in Dairy Science may choose a program from two career emphasis areas: **Science** or **Dairy Industries**. The curricula in the animal and dairy sciences are designed to prepare students for a broad base of rewarding careers in the dynamic disciplines of animal agriculture. Teaching and research facilities, flocks, and herds are available for "hands-on" practical laboratory experiences, along with faculty-mentored research projects. An assigned faculty advisor helps students develop, arrange, and expedite their personal undergraduate program.

Bioveterinary Science (preveterinary) bachelor's degree programs are intended to prepare students for admission to professional veterinary medical schools and/or graduate study in the biomedical sciences. A preveterinary bachelor's degree is considered a nonterminal degree. Preveterinary students may earn a bachelor's degree in Bioveterinary Science, or in the Science Emphasis of Animal Science or Dairy Science.

Instruction in the ADVS Department also encompasses a diversified co-curricular program including allied clubs, intercollegiate livestock judging and rodeo teams, and involvement with their respective professional societies.

## **Animal and Dairy Sciences**

### **Science Emphasis**

Designed for students desiring education beyond the bachelor's degree, this emphasis is a preparatory course of study for students who have a career interest in the following areas: animal research in genetics; reproductive biology, nutrition (public or private sector); biotechnology; teaching; and advanced degrees (MS, PhD, and veterinary school). The Science Emphasis requires an especially close student-advisor relationship, as post-graduate training is considered essential for professional success in these disciplines.

### **Animal (Dairy) Industries Emphasis**

This emphasis is designed to prepare students who earn a bachelor's degree for the broadest range of career opportunities in animal agriculture. The Animal Industries Emphasis stresses both traditional skills in the areas of basic and applied animal sciences and related learning experiences in the other agricultural sciences, as well as in the areas of business administration, economics, and management. Students can select either an advanced research project or an internship experience in the animal industries as an integral component of their program of study during the junior or senior year. Graduates from this emphasis may seek career opportunities in production animal agriculture in farm or ranch management, in state or federal government agricultural agencies, and in fields that support or interact with animal agriculture, such as corporate agribusiness, wholesale and retail marketing and sales, economics, accounting, agricultural real estate sales and appraisal, financing and credit operations, public policy, agricultural media and communications, insurance, commodity trading, animal product processing, agricultural cooperatives, and producer/commodity associations.

## **Animal and Bioveterinary Sciences**

### **Biotechnology Emphasis**

This emphasis is designed to prepare students who earn a bachelor's degree for careers in the expanding biotechnology industry or for graduate study in related fields. Nationwide there are more than 1,200 biotechnology/ biopharmaceutical companies, with additional start-ups developing every year. Recent increases in federal funding for research in animal biotechnology, along with heightened private sector activity, have led to unprecedented career prospects in molecular biology, genomics, bioinformatics, developmental biology, and associated areas. USU has made a major commitment to biotechnology since 1986. The ADVS Department is heavily involved in biotechnology research and teaching, and the resources of the Center for Integrated BioSystems are also available to support this emphasis.

Those students who enjoy lab work and would like to have a BS degree with good job opportunities, and still qualify to apply to veterinary school, may elect to add the Biotechnology Emphasis to their Bioveterinary Science or Animal Science degree.

### **Preveterinary Program**

Preveterinary students take courses required by veterinary schools. Classes should be planned to assure meeting the current requirements for the veterinary schools to which the student plans to apply for admission. In most cases, preveterinary preparation requires a major

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portion of three academic years. Students accepted into veterinary school prior to completion of their BS degree may transfer credits back to USU for completion of their BS degree in Bioveterinary Science.

Utah participates in WICHE (Western Interstate Commission for Higher Education) which provides state subsidization of Utah resident (5 years or longer at the time of application) students entering any veterinary school that is a WICHE-participating school. At present this includes Colorado State University, Washington State University, and Oregon State University. The State of Utah also provides some support for a limited number of resident students who enroll at non-WICHE veterinary schools in the continental United States. Students may also apply to other veterinary schools as out-of-state applicants.

## Vocational Subbaccalaureate Program

### Dairy Herdsman Certificate

Students completing the required courses and experience in the Dairy Herdsman's curriculum usually find employment with a commercial or family dairy. Some enter dairy-related businesses. Students desiring to continue their dairy education may complete a BS degree in three additional years with proper planning and suitable academic performance.

## Requirements

### Departmental Admission Requirements

Undergraduate admission requirements for the Animal Science and Dairy Science programs are the same as those described for the University. Students in good standing may apply for admission to the department. New freshmen admitted to USU in good standing qualify for admission to the Bioveterinary Science major. Students with less than 60 semester credits transferring from other institutions need a 2.2 transfer GPA, and students with less than 60 semester credits transferring from other USU majors need a 2.0 GPA for admission to the Bioveterinary Science major. All students with 60 or more semester credits need a 2.75 total GPA to be admitted to advanced standing in Bioveterinary Science, except that students declaring a Biotechnology Emphasis must have a 2.25 total GPA.

### Departmental Standards

The following minimum requirements apply to all students working toward any bachelor's degree offered by the ADVS department. Bachelor's degree candidates must comply with these requirements in order to graduate: (1) courses required for the major may be repeated only once to improve a grade, and (2) courses required for the major may not be taken for pass-fail credit. In addition to these requirements, Animal Science and Dairy Science bachelor's degree candidates must attain a grade point average of at least 2.50 in the ADVS courses specified as requirements in their respective emphasis curricula to graduate. Animal Science and Dairy Science degree candidates must attain an overall GPA of at least 2.25 to graduate. Bioveterinary Science degree candidates must attain an overall GPA of at least 3.0 to graduate, *except* for students with a Biotechnology Emphasis, who must attain an overall GPA of at least 2.50 to graduate.

## Graduation Requirements

Courses required and recommended for meeting BS degree graduation requirements in the various options available in the department are as follows.

## Animal Science Major

### Animal Industries Emphasis Curriculum (2.25 GPA) Freshman Year (32.5-33.5 credits)

#### Fall Semester (16.5-17.5 credits)

ADVS 1110 Introduction to Animal Science .....	4
ADVS 1910 Orientation to Animal and Dairy Science .....	0.5
ADVS 2130 <sup>5</sup> Dairy Production Practices (3 cr) <b>or</b>	
ADVS 2190 <sup>5</sup> Horse Production Practices (2 cr) .....	2 or 3
BIOL 1010 (BLS) Biology and the Citizen .....	3
MATH 1050 (QL) College Algebra .....	4
Breadth Course <sup>1</sup> .....	3

#### Spring Semester (16 credits)

ADVS 1250 (QI) Applied Agricultural Computations .....	2
ADVS 2200 Anatomy and Physiology of Animals .....	4
ENGL 1010 (CL1) Introduction to Writing: Academic Prose .....	3
ECON 1500 (BAI) Introduction to Economic Institutions, History, and Principles .....	3
ADVS 2080 <sup>5</sup> Beef Production Practices (2 cr) <b>and/or</b>	
ADVS 2090 <sup>5</sup> Sheep Production Practices (2 cr) <b>and/or</b>	
ADVS 2120 <sup>5</sup> Swine Production Practices (2 cr) .....	4

### Sophomore Year (32-33 credits)

#### Fall Semester (16-17 credits)

CHEM 1110 (BPS) General Chemistry I .....	4
STAT 1040 (QL) Introduction to Statistics (3 cr) <b>or</b>	
STAT 2000 (QI) Statistical Methods (3 cr) <b>or</b>	
STAT 2300 (QL) Business Statistics (4 cr) .....	3 or 4
ENGL 2010 (CL2) Intermediate Writing: Research Writing in a Persuasive Mode .....	3
Directed Elective .....	3
Breadth Course <sup>1</sup> .....	3

#### Spring Semester (16 credits)

ADVS 3000 Animal Health and Hygiene .....	3
ASTE 3050 (CI) Technical and Professional Communication Principles in Agriculture .....	3
CHEM 1120 (BPS) General Chemistry II .....	4
Directed Elective <sup>3</sup> .....	3
Breadth Course <sup>1</sup> .....	3

### Junior Year (31 credits)

#### Fall Semester (15 credits)

ADVS 3500 Principles of Animal Nutrition .....	3
Directed Electives <sup>3</sup> .....	9
Free Elective .....	3

#### Spring Semester (16 credits)

ADVS 3510 (QI) Applied Animal Nutrition .....	3
ADVS 4200 (CI) Physiology of Reproduction and Lactation .....	4
ADVS 4250 Internship in Animal Industry (3 cr) <b>or</b>	
ADVS 4800 Undergraduate Research or Creative Opportunity (3 cr) ..	3
Depth Course <sup>2</sup> .....	3
Directed Elective <sup>3</sup> .....	3

### Senior Year (25.5-34.5 credits)

#### Fall Semester (14.5 credits)

ADVS 4560 (QI) Principles of Animal Breeding .....	3
ADVS 4910 Preprofessional Orientation .....	0.5
ADVS 4920 (CI) Undergraduate Seminar .....	2
ADVS 5120 <sup>4</sup> Swine Management .....	3
Depth Course <sup>2</sup> .....	3
Directed Electives <sup>3</sup> .....	3-6

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## Spring Semester (11-20 credits)

<b>ADVS 5080<sup>4</sup></b> Beef Cattle Management (3 cr) <b>and/or</b>	
<b>ADVS 5090<sup>4</sup></b> Sheep Management and Wool Technology (4 cr) <b>and/or</b>	
<b>ADVS 5130<sup>4</sup></b> Dairy Cattle Management (3 cr) <b>and/or</b>	
<b>ADVS 5190<sup>4</sup></b> Horse Management (3 cr) .....	3-7
Directed Electives <sup>3</sup> .....	8-13

<sup>1</sup>Must take one Breadth course from each of the following four categories: Creative Arts, Humanities, Physical Sciences, and Social Sciences. (Note: ECON 1500 fulfills the American Institutions Breadth Course requirement.)

<sup>2</sup>Must take one Depth course from each of the following two categories: Humanities and Creative Arts, and Social Sciences.

<sup>3</sup>Must take four courses from the following list: ACCT 2010; BUS 3400, 3500, 3700; ECON 2010, 3030, 3050, 4010, 4030, 5030; MHR 2990, 3110; and six courses from the following list: one 5000-level species management course in addition to the two courses required for the major; ADVS 3650, 5030, 5520, 5530, 5860; NFS 5020; PLSC 4320; FRWS 2200, 3600, 3850, 4000; SOIL 2000 or 3000.

<sup>4</sup>Must take two courses selected from: ADVS 5080, 5090, 5120, 5130, and 5190.

<sup>5</sup>Must take any three courses selected from: ADVS 2080, 2090, 2120, 2130, and 2190.

## Animal Science Major Science Emphasis Curriculum (2.25 GPA)

### Freshman Year (30.5 credits)

#### Fall Semester (16.5 credits)

<b>ADVS 1110</b> Introduction to Animal Science .....	4
<b>ADVS 1910</b> Orientation to Animal and Dairy Science .....	0.5
<b>CHEM 1210</b> Principles of Chemistry I .....	4
<b>CHEM 1215</b> Chemical Principles Laboratory I .....	1
<b>MATH 1050 (QL)</b> College Algebra .....	4
<b>ENGL 1010 (CL1)</b> Introduction to Writing: Academic Prose .....	3

#### Spring Semester (14 credits)

<b>ADVS 2200</b> Anatomy and Physiology of Animals .....	4
<b>CHEM 1220 (BPS)</b> Principles of Chemistry II .....	4
<b>CHEM 1225</b> Chemical Principles Laboratory II .....	1
<b>ADVS 2080<sup>9</sup></b> Beef Production Practices (2 cr) <b>and/or</b>	
<b>ADVS 2090<sup>9</sup></b> Sheep Production Practices (2 cr) <b>and/or</b>	
<b>ADVS 2120<sup>9</sup></b> Swine Production Practices (2 cr) .....	2-6
Breadth Course <sup>6</sup> .....	3

### Sophomore Year (31-32 credits)

#### Fall Semester (14-15 credits)

<b>ADVS 2130<sup>9</sup></b> Dairy Production Practices (3 cr) <b>or</b>	
<b>ADVS 2190<sup>9</sup></b> Horse Production Practices (2 cr) .....	2 or 3
<b>BIOL 1610</b> Biology I .....	4
<b>CHEM 2310</b> Organic Chemistry I .....	4
<b>CHEM 2315</b> Organic Chemistry Laboratory I .....	1
<b>ENGL 2010 (CL2)</b> Intermediate Writing: Research Writing in a Persuasive Mode .....	3

#### Spring Semester (17 credits)

<b>ADVS 3000</b> Animal Health and Hygiene .....	3
<b>BIOL 1620 (BLS)</b> Biology II .....	4
<b>CHEM 2320</b> Organic Chemistry II .....	4
Breadth Courses <sup>6</sup> (2) .....	6

### Junior Year (33-34 credits)

#### Fall Semester (16-17 credits)

<b>ADVS 3500</b> Principles of Animal Nutrition .....	3
<b>BIOL 3300</b> General Microbiology .....	4
<b>MATH 1100 (QL)</b> Calculus Techniques (3 cr) <b>or</b>	
<b>MATH 1210 (QL)</b> Calculus I (4 cr) .....	3 or 4
<b>STAT 2000 (QI)</b> Statistical Methods .....	3
Breadth Course <sup>6</sup> .....	3

#### Spring Semester (17 credits)

<b>ADVS 3510 (QI)</b> Applied Animal Nutrition .....	3
<b>ADVS 4200 (CI)</b> Physiology of Reproduction and Lactation .....	4

<b>BIOL 3060 (QI)</b> Principles of Genetics .....	4
<b>CHEM 3700</b> Introductory Biochemistry .....	3
Elective <sup>8</sup> .....	3

### Senior Year (27.5-31.5 credits)

#### Fall Semester (15.5 credits)

<b>ADVS 4560 (QI)</b> Principles of Animal Breeding .....	3
<b>ADVS 4910</b> Preprofessional Orientation .....	0.5
<b>ADVS 4920 (CI)</b> Undergraduate Seminar .....	2
<b>ADVS 5120<sup>10</sup></b> Swine Management .....	3
Depth Course <sup>7</sup> .....	3
Electives <sup>8</sup> .....	4-7

#### Spring Semester (12-16 credits)

<b>ADVS 4250</b> Internship in Animal Industry (3 cr) <b>or</b>	
<b>ADVS 4800</b> Undergraduate Research or Creative Opportunity (3 cr) ..	3
<b>ADVS 5080<sup>10</sup></b> Beef Cattle Management (3 cr) <b>and/or</b>	
<b>ADVS 5090<sup>10</sup></b> Sheep Management and Wool Technology (4 cr) <b>and/or</b>	
<b>ADVS 5130<sup>10</sup></b> Dairy Cattle Management (3 cr) <b>and/or</b>	
<b>ADVS 5190<sup>10</sup></b> Horse Management (3 cr) .....	3-7
Depth Course <sup>7</sup> .....	3
Electives <sup>8</sup> .....	3

<sup>6</sup>Must take one Breadth course from each of the following four categories: American Institutions, Creative Arts, Humanities, and Social Sciences.

<sup>7</sup>Must take one Depth course from each of the following two categories: Humanities and Creative Arts, and Social Sciences.

<sup>8</sup>Recommended electives include: ADVS 5160, 5240, 5260; CHEM 3710; PHYS 2110.

<sup>9</sup>Must choose two courses from: ADVS 2080, 2090, 2120, 2130, and 2190.

<sup>10</sup>Must choose two courses from: ADVS 5080, 5090, 5120, 5130, and 5190.

## Animal Science Major Biotechnology Emphasis Curriculum (2.25 GPA)

### Freshman Year (32.5 credits)

#### Fall Semester (16.5 credits)

<b>ADVS 1110</b> Introduction to Animal Science .....	4
<b>ADVS 1910</b> Orientation to Animal and Dairy Science .....	0.5
<b>CHEM 1210</b> Principles of Chemistry I .....	4
<b>CHEM 1215</b> Chemical Principles Laboratory I .....	1
<b>MATH 1050 (QL)</b> College Algebra .....	4
<b>ENGL 1010 (CL1)</b> Introduction to Writing: Academic Prose .....	3

#### Spring Semester (16 credits)

<b>ADVS 2040</b> Introduction to Biotechnology .....	1
<b>ADVS 2200</b> Anatomy and Physiology of Animals .....	4
<b>CHEM 1220 (BPS)</b> Principles of Chemistry II .....	4
<b>CHEM 1225</b> Chemical Principles Laboratory II .....	1
<b>STAT 1040 (QL)</b> Introduction to Statistics (3 cr) <b>or</b>	
<b>STAT 2000 (QI)</b> Statistical Methods (3 cr) .....	3
Breadth Course <sup>11</sup> .....	3

### Sophomore Year (29 credits)

#### Fall Semester (15 credits)

<b>BIOL 1610</b> Biology I .....	4
<b>CHEM 2310</b> Organic Chemistry I .....	4
<b>CHEM 2315</b> Organic Chemistry Laboratory I .....	1
<b>ENGL 2010 (CL2)</b> Intermediate Writing: Research Writing in a Persuasive Mode .....	3
Breadth Course <sup>11</sup> .....	3

#### Spring Semester (14 credits)

<b>BIOL 1620 (BLS)</b> Biology II .....	4
<b>CHEM 2320</b> Organic Chemistry II .....	4
Breadth Courses <sup>11</sup> (2) .....	6

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## Junior and Senior Years (58 credits)

### Required Classes

ADVS 3020 Biotechnology in Agriculture (F)	3
ADVS 3200 Ethical Issues in Genetic Engineering and Biotechnology (Sp)	3
ADVS 4260 Internship in Animal Biotechnology Industry (F,Sp,Su)	3-12
ADVS 5160 Methods in Biotechnology: Cell Culture (Sp)	3
ADVS 5260 Methods in Biotechnology: Molecular Cloning (F)	3
ADVS 5280 Animal Molecular Biology (Sp)	3
BIOL 3060 (QI) Principles of Genetics (F,Sp,Su)	4
BIOL 3300 General Microbiology (F,Sp)	4
CHEM 3700 Introductory Biochemistry (Sp)	3
Two University Studies Depth Courses <sup>12</sup>	6

### Directed Electives (14-23 credits; must include two CI classes)

ADVS 3000 Animal Health and Hygiene (Sp)	3
ADVS 3500 Principles of Animal Nutrition (F)	3
ADVS 3510 (QI) Applied Animal Nutrition (Sp)	3
ADVS 4200 (CI) Physiology of Reproduction and Lactation (Sp)	4
ADVS 4560 (QI) Principles of Animal Breeding (F)	3
ADVS 5690 Animal Histology (F)	3
ADVS 5700 (CI) General Animal Pathobiology (Sp)	3
ADVS 5820 Animal Cytogenetics and Gene Mapping (F)	3
BIOL 3065 Genetics Laboratory (F)	1
BIOL 5150 Immunology (Sp)	3
BIOL 5190 Molecular Genetics (Sp)	3
BIOL 5210 Cell Biology (F)	3
BIOL 5230 Developmental Biology (Sp)	3
BIOL 5600 Comparative Animal Physiology (F)	3
PHYS 2110 The Physics of Living Systems I	4
PHYS 2120 (BPS) The Physics of Living Systems II	4

<sup>11</sup>Must take one Breadth course from each of the following four categories: American Institutions, Creative Arts, Humanities, and Social Sciences.

<sup>12</sup>Must take one Depth course from each of the following two categories: Humanities and Creative Arts, and Social Sciences.

## Dairy Science Major

### Dairy Industries Emphasis Curriculum (2.25 GPA)

#### Freshman Year (29.5 credits)

##### Fall Semester (14.5 credits)

ADVS 1110 Introduction to Animal Science	4
ADVS 1910 Orientation to Animal and Dairy Science	0.5
ADVS 2130 Dairy Production Practices	3
BIOL 1010 (BLS) Biology and the Citizen	3
MATH 1050 (QL) College Algebra	4

##### Spring Semester (15 credits)

ADVS 1250 (QI) Applied Agricultural Computations	2
ADVS 2200 Anatomy and Physiology of Animals	4
ENGL 1010 (CL1) Introduction to Writing: Academic Prose	3
ECON 1500 (BAI) Introduction to Economic Institutions, History, and Principles	3
Breadth Course <sup>13</sup>	3

#### Sophomore Year (29-31 credits)

##### Fall Semester (13-14 credits)

CHEM 1110 (BPS) General Chemistry I	4
ENGL 2010 (CL2) Intermediate Writing: Research Writing in a Persuasive Mode	3
STAT 1040 (QL) Introduction to Statistics (3 cr) or	
STAT 2000 (QI) Statistical Methods (3 cr) or	
STAT 2300 (QL) Business Statistics (4 cr)	3 or 4
Breadth Course <sup>13</sup>	3

#### Spring Semester (16-17 credits)

ADVS 3000 Animal Health and Hygiene	3
ASTE 3050 (CI) Technical and Professional Communication Principles in Agriculture	3
CHEM 1120 (BPS) General Chemistry II	4
SOIL 2000 (BPS) Soils, Waters, and the Environment (3 cr) or	
SOIL 3000 Fundamentals of Soil Science (4 cr)	3 or 4
Breadth Course <sup>13</sup>	3

#### Junior Year (30 credits)

##### Fall Semester (14 credits)

ADVS 3500 Principles of Animal Nutrition	3
Depth Course <sup>14</sup>	3
Directed Electives <sup>15</sup>	8

##### Spring Semester (16 credits)

ADVS 3510 (QI) Applied Animal Nutrition	3
ADVS 4200 (CI) Physiology of Reproduction and Lactation	4
ADVS 4250 Internship in Animal Industry (3 cr) or	
ADVS 4800 Undergraduate Research or Creative Opportunity (3 cr)	3
Depth Course <sup>14</sup>	3
Directed Elective	3

#### Senior Year (30.5 credits)

##### Fall Semester (15.5 credits)

ADVS 4560 (QI) Principles of Animal Breeding	3
ADVS 4910 Preprofessional Orientation	0.5
ADVS 4920 (CI) Undergraduate Seminar	2
NFS 4900 ST: Dairy Food Processing	4
Directed Elective <sup>15</sup>	3
Free Elective	3

##### Spring Semester (15 credits)

ADVS 5130 Dairy Cattle Management	3
Directed Electives <sup>15</sup>	9
Free Elective	3

<sup>13</sup>Must take one Breadth course from each of the following four categories: Creative Arts, Humanities, Physical Sciences, and Social Sciences. (Note: ECON 1500 fulfills the American Institutions Breadth Course requirement.)

<sup>14</sup>Must take one Depth course from each of the following two categories: Humanities and Creative Arts, and Social Sciences.

<sup>15</sup>Must take four courses from the following list: ACCT 2010; BUS 3400, 3500, 3700; ECON 2010, 3030, 3050, 4010, 4030, 5030; MHR 2050, 3110; and three courses from the following list: ADVS 5030, 5520, 5530; ASTE 3600, 4100; PLSC 4320.

## Dairy Science Major

### Science Emphasis Curriculum (2.25 GPA)

#### Freshman Year (31.5-32.5 credits)

##### Fall Semester (16.5 credits)

ADVS 1110 Introduction to Animal Science	4
ADVS 1910 Orientation to Animal and Dairy Science	0.5
CHEM 1210 Principles of Chemistry I	4
CHEM 1215 Chemical Principles Laboratory I	1
MATH 1050 (QL) College Algebra	4
ENGL 1010 (CL1) Introduction to Writing: Academic Prose	3

##### Spring Semester (15-16 credits)

ADVS 2200 Anatomy and Physiology of Animals	4
CHEM 1220 (BPS) Principles of Chemistry II	4
CHEM 1225 Chemical Principles Laboratory II	1
MATH 1100 (QL) Calculus Techniques (3 cr) or	
MATH 1210 (QL) Calculus I (4 cr)	3 or 4
Breadth Course <sup>16</sup>	3

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## Sophomore Year (32 credits)

### Fall Semester (15 credits)

ADVS 2130 Dairy Production Practices .....	3
BIOL 1610 Biology I .....	4
CHEM 2310 Organic Chemistry I .....	4
CHEM 2315 Organic Chemistry Laboratory I .....	1
ENGL 2010 (CL2) Intermediate Writing: Research Writing in a Persuasive Mode .....	3

### Spring Semester (17 credits)

ADVS 3000 Animal Health and Hygiene .....	3
ASTE 3090 Computer Applications in Agriculture .....	3
BIOL 1620 (BLS) Biology II .....	4
CHEM 2320 Organic Chemistry II .....	4
Breadth Course <sup>16</sup> .....	3

## Junior Year (30 credits)

### Fall Semester (13 credits)

ADVS 3500 Principles of Animal Nutrition .....	3
BIOL 3300 General Microbiology .....	4
STAT 2000 (QI) Statistical Methods .....	3
Breadth Course <sup>16</sup> .....	3

### Spring Semester (17 credits)

ADVS 3510 (QI) Applied Animal Nutrition .....	3
ADVS 4200 (CI) Physiology of Reproduction and Lactation .....	4
BIOL 3060 (QI) Principles of Genetics .....	4
CHEM 3700 Introductory Biochemistry .....	3
Breadth Course <sup>16</sup> .....	3

## Senior Year (30.5 credits)

### Fall Semester (15.5 credits)

ADVS 4560 (QI) Principles of Animal Breeding .....	3
ADVS 4910 Preprofessional Orientation .....	0.5
ADVS 4920 (CI) Undergraduate Seminar .....	2
Depth Course <sup>17</sup> .....	3
Electives <sup>18</sup> .....	7

### Spring Semester (15 credits)

ADVS 4250 Internship in Animal Industry (3 cr) or	
ADVS 4800 Undergraduate Research or Creative Opportunity (3 cr) ..	3
ADVS 5130 Dairy Cattle Management .....	3
Depth Course <sup>17</sup> .....	3
Electives <sup>18</sup> .....	6

<sup>16</sup>Must take one Breadth course from each of the following four categories: American Institutions, Creative Arts, Humanities, and Social Sciences.

<sup>17</sup>Must take one Depth course from each of the following two categories: Humanities and Creative Arts, and Social Sciences.

<sup>18</sup>Recommended Electives include ADVS 5160, 5240, 5260; CHEM 3710; PHYS 2110.

## Bioveterinary Science (Preveterinary)

### Major Requirements

(120 credits) (3.0 min. total GPA) (2.5 min. total GPA if including Biotechnology Emphasis)

This is a four-year program, preparing students for application to and admittance to veterinary school or graduate school, or for finding employment in biotechnology research. Courses required for the major may not be taken pass-fail, except for ADVS 3920. In recent years, nearly all students who have been accepted to veterinary school have had at least a 3.4 GPA.

### Advanced Standing Requirements

To attain Advanced Standing in Bioveterinary Science, students must have completed or must be currently registered for a minimum of 60 semester credits, and must have earned an overall GPA of at least

2.75 for all credits, including transfer credits, taken up to the time the petition for Advanced Standing is made. If declaring the Biotechnology Emphasis, students must have earned an overall GPA of at least 2.25.

Students' records will be checked when they reach a total of 60 semester credits. Those who do not meet advanced standing requirements will be notified to meet with their advisor.

## Semester Schedule

### Freshman Year (30 credits)<sup>19</sup>

#### Fall Semester (15 credits)

ADVS 1110 Introduction to Animal Science .....	4
ADVS 1920 Orientation to Bioveterinary Science .....	1
CHEM 1210 <sup>20,21</sup> Principles of Chemistry I .....	4
CHEM 1215 <sup>20</sup> Chemical Principles Laboratory I .....	1
MATH 1100 (QL) <sup>20,22</sup> Calculus Techniques .....	3
Electives .....	2

#### Spring Semester (15 credits)

ADVS 2200 Anatomy and Physiology of Animals .....	4
CHEM 1220 (BPS) <sup>20</sup> Principles of Chemistry II .....	4
CHEM 1225 <sup>20</sup> Chemical Principles Laboratory II .....	1
ENGL 1010 (CL) <sup>20,23</sup> Introduction to Writing: Academic Prose .....	3
University Studies Breadth Course <sup>20,24</sup> .....	3

### Summer Semester

ADVS 3920, Internship in Veterinary Medicine, is a recommended option. Students may count up to 2 credits of ADVS 3920 as elective upper-division credits toward graduation.

## Sophomore Year (30.5 credits)

### Fall Semester (15 credits)

ADVS 3500 Principles of Animal Nutrition .....	3
BIOL 1610 <sup>20</sup> Biology I .....	4
CHEM 2310 <sup>20</sup> Organic Chemistry I .....	4
CHEM 2315 <sup>20</sup> Organic Chemistry Laboratory I .....	1
University Studies Breadth Course <sup>20,24</sup> .....	3

### Spring Semester (15.5 credits)

BIOL 1620 (BLS) <sup>20</sup> Biology II .....	4
CHEM 2320 <sup>20</sup> Organic Chemistry II .....	4
ADVS 2920 Orientation to Veterinary Medicine .....	0.5
BIOL 3060 (QI) <sup>20</sup> Principles of Genetics .....	4
University Studies Breadth Course <sup>20,24</sup> .....	3

## Junior Year (33 credits)

### Fall Semester (17 credits)

BIOL 3300 <sup>20</sup> General Microbiology .....	4
PHYS 2110 <sup>20</sup> The Physics of Living Systems I .....	4
ENGL 2010 (CL) <sup>20</sup> Intermediate Writing: Research Writing in a Persuasive Mode .....	3
STAT 2000 (QI) Statistical Methods .....	3
University Studies Breadth Course <sup>20,24</sup> .....	3

### Spring Semester (16 credits)

ADVS 3000 Animal Health and Hygiene .....	3
PHYS 2120 (BPS) The Physics of Living Systems II .....	4
CHEM 3700 <sup>20</sup> Introductory Biochemistry .....	3
Two Upper-division University Studies Depth Courses <sup>25</sup> .....	6

## Senior Year (at least 29 credits)

Students must complete at least 120 semester credits for the BS degree, of which 40 credits must be in upper-division courses. The student must complete two courses which are communications intensive, and one course which is quantitative intensive. Students must include at least 15 credits from the following list. An additional 7

# Department of Animal, Dairy and Veterinary Sciences

elective credits are needed to complete the 120 credits required for graduation. Other upper-division life sciences courses may be applied to this requirement if approved by a bioveterinary science advisor.

<b>ADVS 3510 (QI)</b> Applied Animal Nutrition (Sp) .....	3
<b>ADVS 4200 (CI)</b> Physiology of Reproduction and Lactation (Sp) .....	4
<b>ADVS 4560 (QI)</b> Principles of Animal Breeding (F) .....	3
<b>ADVS 5690</b> Animal Histology (F) .....	3
<b>ADVS 5700 (CI)</b> General Animal Pathobiology (Sp) .....	3
<b>BIOL 5150</b> Immunology (Sp).....	3
<b>BIOL 5210</b> Cell Biology (F) .....	3
<b>BIOL 5230</b> Developmental Biology (Sp) .....	3
<b>BIOL 5330</b> Virology (Sp) .....	3
<b>BIOL 5600</b> Comparative Animal Physiology (F).....	3
<b>BIOL 5610 (QI)</b> Animal Physiology Laboratory (F,Sp).....	2
<b>BIOL 5620</b> Medical Physiology (Sp) .....	3

## Bioveterinary Science Major Biotechnology Emphasis

### Semester Schedule

#### Freshman Year (30 credits)<sup>19</sup>

##### Fall Semester (14 credits)

<b>ADVS 1110</b> Introduction to Animal Science .....	4
<b>ADVS 1920</b> Orientation to Bioveterinary Science .....	1
<b>CHEM 1210<sup>20,21</sup></b> Principles of Chemistry I .....	4
<b>CHEM 1215<sup>20</sup></b> Chemical Principles Laboratory I.....	1
<b>MATH 1100 (QL)<sup>20,22</sup></b> Calculus Techniques.....	3
Elective .....	1

##### Spring Semester (16 credits)

<b>ADVS 2040</b> Introduction to Biotechnology .....	1
<b>ADVS 2200</b> Anatomy and Physiology of Animals .....	4
<b>CHEM 1220 (BPS)<sup>20,26</sup></b> Principles of Chemistry II.....	4
<b>CHEM 1225<sup>20</sup></b> Chemical Principles Laboratory II.....	1
<b>ENGL 1010 (CL)<sup>20,23</sup></b> Introduction to Writing: Academic Prose.....	3
University Studies Breadth Course <sup>20,24</sup> .....	3

#### Sophomore Year (32 credits)

##### Fall Semester (15 credits)

<b>BIOL 1610<sup>20</sup></b> Biology I.....	4
<b>CHEM 2310<sup>20</sup></b> Organic Chemistry I.....	4
<b>CHEM 2315<sup>20</sup></b> Organic Chemistry Laboratory I .....	1
Two University Studies Breadth Courses <sup>20,24</sup> .....	6

##### Spring Semester (17 credits)

<b>BIOL 1620 (BLS)<sup>20</sup></b> Biology II.....	4
<b>CHEM 2320<sup>20</sup></b> Organic Chemistry II.....	4
<b>CHEM 3700<sup>20</sup></b> Introductory Biochemistry .....	3
<b>ENGL 2010 (CL)<sup>20</sup></b> Intermediate Writing: Research Writing in a Persuasive Mode.....	3
University Studies Breadth Course <sup>20,24</sup> .....	3

#### Junior and Senior Years (58 credits)

##### Required Classes

<b>ADVS 3020</b> Biotechnology in Agriculture (F) .....	3
<b>ADVS 3200</b> Ethical Issues in Genetic Engineering and Biotechnology (Sp).....	3
<b>ADVS 4260</b> Internship in Animal Biotechnology Industry (F,Sp,Su).....	3-12
<b>ADVS 5160</b> Methods in Biotechnology: Cell Culture (Sp).....	3
<b>ADVS 5260</b> Methods in Biotechnology: Molecular Cloning (F).....	3
<b>ADVS 5280</b> Animal Molecular Biology (Sp) .....	3
<b>BIOL 3060 (QI)<sup>20</sup></b> Principles of Genetics (F,Sp,Su) .....	4
<b>BIOL 3300<sup>20</sup></b> General Microbiology (F,Sp).....	4
<b>STAT 2000 (QI)<sup>20</sup></b> Statistical Methods (F,Sp).....	3
Two University Studies Depth Courses <sup>25</sup> .....	6

#### Directed Electives (14-23 credits; must include two CI classes)

<b>ADVS 3000</b> Animal Health and Hygiene (Sp) .....	3
<b>ADVS 3500</b> Principles of Animal Nutrition (F) .....	3
<b>ADVS 3510 (QI)</b> Applied Animal Nutrition (Sp) .....	3
<b>ADVS 4200 (CI)</b> Physiology of Reproduction and Lactation (Sp) .....	4
<b>ADVS 4560 (QI)</b> Principles of Animal Breeding (F).....	3
<b>ADVS 5350</b> Introductory Pharmacology and Pharmacokinetics (Sp) ...	3
<b>ADVS 5690</b> Animal Histology (F) .....	3
<b>ADVS 5700 (CI)</b> General Animal Pathobiology (Sp) .....	3
<b>ADVS 5820</b> Animal Cytogenetics and Gene Mapping (F).....	3
<b>BIOL 3065</b> Genetics Laboratory (F).....	1
<b>BIOL 5150</b> Immunology (Sp).....	3
<b>BIOL 5190</b> Molecular Genetics (Sp) .....	3
<b>BIOL 5210</b> Cell Biology (F) .....	3
<b>BIOL 5230</b> Developmental Biology (Sp) .....	3
<b>BIOL 5600</b> Comparative Animal Physiology (F).....	3
<b>PHYS 2110<sup>26</sup></b> The Physics of Living Systems I.....	4
<b>PHYS 2120 (BPS)</b> The Physics of Living Systems II .....	4

<sup>19</sup>If a student is unable to pass the Computer and Information Literacy (CIL) Test, USU 1000 and OSS 1400 should be taken the first year.

<sup>20</sup>Required for Colorado, Washington, and Oregon veterinary schools.

<sup>21</sup>Students with little exposure to chemistry or an ACT Math score less than 25 will need to begin with a lower-level chemistry class and/or take MATH 1050 first. (See an advisor for assistance.)

<sup>22</sup>Students with math ACT scores of less than 25 must start with a lower-level class.

<sup>23</sup>Can also be met by an AP English Language and Composition or Literature and Composition test score of 3 or higher, an ACT English test score of 29 or higher, a CLEP English Composition test score of 50 or higher, a CLEP Freshman College Composition test score of 53 or higher, or an SAT Verbal test score of 640 or higher.

<sup>24</sup>Must take one Breadth course from each of the following four categories: Humanities, Creative Arts, Social Sciences, and American Institutions. Two of these courses must be taken with a USU prefix. AP or CLEP tests may be used to fulfill some Breadth requirements.

<sup>25</sup>Two approved Depth courses are required: one in Humanities and Creative Arts and one in Social Sciences (3000 level or higher). It is recommended that one of these courses be a Communications Intensive (CI) course.

<sup>26</sup>PHYS 2110 must be taken if the student plans to apply to veterinary school in Colorado, Washington, or Oregon.

## Dairy Herdsman Program

### The Program

The Dairy Herdsman Program is a one-year course of study in practical dairy knowledge and skills. Through lectures, laboratory exercises, and actual on-the-farm experiences, students are taught to be dairy herdsman, with highly employable skills. A high school education is highly recommended, but is not a requirement to be admitted to the program.

The classroom and laboratory experiences are directed by Utah State University staff members, extension personnel, and specially qualified guest speakers. Coursework covers such areas as nutrition and feeding, management, physiology, milk production, breeding and selection, and buildings and equipment. Students also gain practical experience and know-how by working with a commercial dairyman in Cache Valley. Many students are now selecting the new degree option, which allows students to take the dairy herdsman classwork and then continue on for a degree in dairy science.

All students may participate in judging at regional and national levels, showing at state and area shows, working with area sales, and field trips to the Western International Dairy Expo, the Dairy Herd Improvement Laboratory, and progressive dairy enterprises. These activities provide a well-rounded background and improve employment opportunities.

Students in this program have access to all privileges available to Utah State University students: athletic and entertainment events, campus housing and food services, the University library, the bookstore, and recreational facilities.

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## Career Opportunities

Students who complete this program will have a good working knowledge of how to care for and make decisions about various dairy animals and will understand and be able to use various types of equipment. These skills, as well as an understanding of the management process involved, can greatly improve the chances of being employed by a dairy or dairy-related industry.

### Required Coursework for Dairy Herdsman Program Fall Semester (16 credits)

ADVS 1010 Artificial Insemination and Reproduction .....	2
ADVS 1020 Dairy Cattle Nutrition and Feeding .....	3
ADVS 1050 Dairy Genetics .....	3
ADVS 1250 Applied Agricultural Computations.....	2
ADVS 2130 Dairy Production Practices .....	3
ADVS 2250 Cooperative Work Experience.....	3

### Spring Semester (16 credits)

ADVS 1030 Lactation and Milking Systems .....	3
ADVS 1040 Records and Financial Aspects of Dairy Herd Operations 3	
ADVS 1060 Applied Feeding and Management of Dairy Calves and Basic Construction of Facilities .....	3
ADVS 1720 Dairy Cattle Evaluation and Judging .....	1
ADVS 2250 Cooperative Work Experience.....	6

## Honors

There is also an Honors Plan for students desiring a BS degree "with Honors" in Animal/Dairy/Bioveterinary Science. For details, students should contact their academic advisor.

## ADVS Minors

A minor can be valuable when associated with a major in agricultural education, agricultural economics, plant science, nutrition and food science, business, economics, computer science, rangeland resources, and in other disciplines where the animal industry has direct or indirect involvement.

Requirements for specialty or emphasis area minors are listed below. The same departmental standards applying to animal science and dairy science majors also apply to all minors (see page 147).

### Requirements for Minors

The following is a listing of courses for the various minor emphasis areas. A specific course may not be used to fulfill the requirements of more than one ADVS minor.

#### General Animal Science

ADVS 1110; choose one or more courses from ADVS 2080, 2090, 2120, 2190; 10 elective ADVS credits with approval of an animal science advisor.

#### General Dairy Science

ADVS 1110, 2130; 10 elective ADVS credits with approval of a dairy science advisor.

#### Biovetterinary Science

ADVS 2200, 3000; 7 elective ADVS credits with approval of a biovetterinary science advisor. A minimum grade of C is required in all courses applied toward this minor.

#### Horse Production

ADVS 1110, 2190, 2250; 6 or more elective ADVS credits with approval of an animal science advisor.

#### Horse Training

ADVS 1110, 1600, 2190, 2600; 2 or more elective ADVS credits with approval of an animal science advisor.

#### Dairy Herdsman

ADVS 1020, 1030, 1040, 1050, 1060. (*Not available to Dairy Science Majors.*)

Transfer students must have a minimum of one 3-credit upper-division course in residency with the approval of an ADVS advisor.

## Undergraduate Program Assessment

The ADVS Department assessment plan defines learning objectives for each of its undergraduate programs. These learning objectives are mapped to each of the required courses in each program, so that they may be evaluated for their contribution to program goals. Outcome measures have also been defined for each program, and a process has been implemented to conduct exit interviews with all graduating students in Animal and Dairy Science. Rate of admission to a professional veterinary medical program has been identified as the critical outcome measure for the Biovetterinary Science program. The ADVS Department Curriculum Committee oversees the assessment process, with input from the ADVS Department Internship and Placement Committee. The ADVS Curriculum Committee reports its assessment findings to the ADVS department head, as well as to faculty members, and incorporates these findings in its regular ongoing and periodic comprehensive reviews and revisions of the ADVS Department undergraduate programs.

## Learning Objectives

### Animal Science Major (Animal Industries Emphasis)

The following *Disciplinary Knowledge* objectives apply:

1. Attain knowledge in mathematics and basic sciences required for disciplinary competency.
2. Know the nature, intent, and scope of animal science.
3. Attain depth in two subfields of animal science.
4. Achieve understanding in the disciplines of animal genetics, health, nutrition, and reproduction.
5. Integrate knowledge from the various disciplines to effectively conduct livestock operations.

*Skills and Career Competencies* objectives are as follows:

1. Comprehend reading materials appropriate to course levels.
2. Communicate effectively in oral and written forms.
3. Conduct library research using modern methods.
4. Use a computer for written work, presentations, and research.
5. Attain proficiency in basic techniques of animal management.

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## **Animal Science and Dairy Science Majors (Science Emphasis)**

The following *Disciplinary Knowledge* objectives apply:

1. Attain knowledge in mathematics and basic sciences required for disciplinary competency.
2. Know the nature, intent, and scope of animal/dairy science.
3. Attain depth in one subfield of animal/dairy science.
4. Achieve understanding in the disciplines of animal genetics, health, nutrition, and reproduction.
5. Effectively integrate knowledge from basic sciences to applications in the animal sciences.

*Skills and Career Competencies* objectives are as follows:

1. Comprehend reading materials appropriate to course levels.
2. Communicate effectively in oral and written forms.
3. Conduct library research using modern methods.
4. Use a computer for written work, presentations, and research.

## **Animal Science and Bioveterinary Science Majors (Biotechnology Emphasis)**

The following *Disciplinary Knowledge* objectives apply:

1. Attain a working knowledge of biological mechanisms, including genetics, reproduction, and microbiology.
2. Acquire a working knowledge of mathematics, including calculus and statistics.
3. Achieve a working knowledge of chemistry, including inorganic, organic, and biochemistry.
4. Attain a basic knowledge of animal biotechnology and ethics.

*Skills and Career Competencies* objectives are as follows:

1. Understand and perform molecular cloning.
2. Understand and perform cell culture procedures.
3. Understand and perform protein purification.
4. Communicate effectively in oral and written forms.
5. Achieve quantitative competency.
6. Conduct scientific-literature searches using modern methods.

## **Bioveterinary Science Major**

The following *Disciplinary Knowledge* objectives apply:

1. Attain a working knowledge of biological mechanisms, including molecular genetics.
2. Acquire a working knowledge of mathematics, including calculus and statistics.

3. Achieve a working knowledge of chemistry, including inorganic, organic, and biochemistry.
4. Acquire a basic knowledge of general physics.
5. Attain a basic knowledge of animal production, including breeding, nutrition, and reproduction.
6. Achieve a basic understanding of health and disease mechanisms.
7. Understand the ethics and profession of veterinary medicine.

*Skills and Career Competencies* objectives are as follows:

1. Communicate effectively in oral and written forms.
2. Achieve quantitative competency.
3. Conduct scientific literature searches using modern methods.

## **Dairy Science Major (Dairy Industries Emphasis)**

The following *Disciplinary Knowledge* objectives apply:

1. Attain knowledge in mathematics and basic sciences required for disciplinary competency.
2. Know the nature, intent, and scope of dairy science.
3. Achieve understanding in the disciplines of animal genetics, health, nutrition, reproduction, and lactation.
4. Integrate knowledge from the various disciplines to effectively conduct dairy operations.

*Skills and Career Competencies* objectives are as follows:

1. Comprehend reading materials appropriate to course levels.
2. Communicate effectively in oral and written forms.
3. Conduct library research using modern methods.
4. Use a computer for written work, presentations, and research.
5. Attain proficiency in basic techniques of animal management.

## **Undergraduate Research Opportunities**

Students interested in pursuing undergraduate research opportunities in the ADVS Department should contact Jeffrey L. Walters, Agricultural Science 246, jeffrey.walters@usu.edu, (435) 797-2161, for information and referrals.

## **Departmental Honors**

Students who would like to experience greater academic depth within their major are encouraged to enroll in departmental honors. Departmental honors programs are available for students majoring in Animal Science, Dairy Science, or Bioveterinary Science. Through original, independent work, Honors students enjoy the benefits of close supervision and mentoring, as they work one-on-one with faculty in select upper-division departmental courses. Honors students also

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complete a senior project, which provides another opportunity to collaborate with faculty on a problem that is significant, both personally and in the student's discipline. Participating in departmental honors enhances students' chances for obtaining fellowships and admission to graduate school.

ADVS students qualify for acceptance into the departmental honors program by having a cumulative GPA of 3.3 or better at the time of application. The program of study requires the completion of 15 credits of upper-division (3000-level or above) classwork as follows: One credit of HONR 4800H, Thesis/Project Seminar; 3 to 6 credits of HONR 4900H, Senior Thesis/Project; and 8 to 11 credits of upper-division Honors coursework by contract (3 credits may be taken outside the ADVS Department). Completion of the degree requires a cumulative GPA of 3.3 and a 3.5 GPA in upper-division Honors classes. Examples of departmental classes which may be suitable as Honors courses by contract are ADVS 3000, 3200, 3500, 3510, 4200, 4560, 5160, 5240, 5260, 5350, 5400, 5520, 5530, 5690, 5700, and 5820. Students should plan their Honors Program early, so that their thesis project can be completed during the first semester of their senior year, and their last semester can be used to write and present their thesis.

Interested students should contact the Honors Program, Main 15, (435) 797-2715, [honors@cc.usu.edu](mailto:honors@cc.usu.edu). Additional information can be found online at: <http://www.usu.edu/honors/>

## Additional Information and Updates

For more information about Bachelor of Science requirements and the sequence in which courses should be taken, see major requirement sheets. For more information on ADVS Department minors, see minor requirement sheet. These are available from the ADVS Department advisor's office (AG S 242). Major requirement sheets can also be found online at: <http://www.usu.edu/ats/majorsheets/>

Successful completion of a bachelor's degree program in the ADVS Department requires that a very close student-academic advisor relationship be established and continued through each student's bachelor's degree program. Each student must take the responsibility of establishing this close working relationship with his or her advisor. Doing this soon after the student's entry into the department can keep academic problems to a minimum.

For updated information on ADVS programs and course offerings, check the departmental home page at: <http://www.advs.usu.edu>

## Safety and Liability in Classes and Laboratories

Certain classes and laboratories involve a risk of bodily injury or of damage to clothing. Students should take appropriate precautions and wear suitable protective clothing. Some of the risks include handling or being near animals, slick floors or corrals, use of toxic or corrosive substances, and the use of sharp or breakable instruments and equipment. Students should take precautions to avoid fainting during demonstrations or work with animal tissues or operative procedures. Students must assume their own liability protection for travel to and from classes, laboratories, and field trips. The University and its employees assume no liability in the performance of classroom or laboratory instruction or on scheduled field trips, or for other dangerous activities. The student, by voluntarily participating in these classes and activities, agrees to assume the risk and not hold USU or its staff liable.

## Financial Support

In addition to the scholarships and other financial aid available through the University, the department awards designated scholarships to qualified students. The department employs students on a part-time basis to assist with its research and operate its animal facilities. The department also coordinates cooperative education and internship employment opportunities for students. For more information, contact the department.

## Graduate Programs

### Admission Requirements

In addition to the general admission requirements (see pages 99-100), applicants should have satisfactory (3.0 GPA or better) grades in completion of previous degree programs. GRE exam, verbal, quantitative, and analytical scores at or above the 40th percentile are required.

The applicant for a graduate program in animal or dairy science should have completed a BS undergraduate program similar to the USU animal science or dairy science Science Emphasis BS degree. This background would include the following courses and their prerequisites: BIOL 1610 and 1620 or their equivalents; CHEM 2310 and 2320 or their equivalents; MATH 1050 and STAT 1040 or their equivalents. Applicants with deficiencies in these areas may be admitted to the graduate program subject to the completion of remedial coursework specified by the department. Other preparatory courses may be specified by the student's supervisory committee.

Applicants to the bioveterinary science graduate program should have a degree in bioveterinary science, biology, microbiology, chemistry, or one of the animal sciences. Preveterinary students oriented towards graduate research studies are strongly encouraged to apply.

## Degree Programs

### Master of Science

The MS is available to qualified students with bachelor's degrees. MS degrees are offered by the department in animal science and dairy science, with five specializations in each, and in bioveterinary science.

### Doctor of Philosophy

The PhD degree in animal science is offered with four specializations. It is available to qualified students with master's degrees in related disciplines. Exceptionally well-qualified applicants may be considered for admission to a postbaccalaureate PhD program. The PhD degree in bioveterinary science has three specializations and is available to qualified students holding a DVM or a master's degree in a related discipline, or exceptionally well-qualified postbaccalaureate applicants. The PhD is a terminal research degree that is awarded upon successful completion of a comprehensive program of coursework and original research in an approved area of specialization.

## Specializations in Animal/Dairy Science

### Animal Nutrition

This specialization involves studies in biochemistry, principles of nutrition, animal management, nutritional physiology, and animal feedstuffs. Cooperation with producers, feed industry groups, other

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departments of the University, and USDA collaborators, along with research funding from private industry, strengthens the graduate program in this area.

*Course requirements:* Students in the MS program are required to complete the following courses: ADVS 6800, any four ADVS graduate nutrition courses at the discretion of the supervisory committee; one 5000-level Statistics course. Students in the MS program are required to complete or to have completed CHEM 3700 or its equivalent, but will not receive graduate credit for it. Students in the PhD program are required to meet or have met all MS program requirements, as well as to complete the following coursework: ADVS 6800 (additional to the MS requirement), ADVS graduate nutrition courses as directed by the supervisory committee; CHEM 5700, 5710; one 5000-level Statistics course (additional to the MS requirement); additional coursework at the discretion of the supervisory committee to a total of at least 30 credits.

## Breeding and Genetics

This specialization involves studies in quantitative genetics, applied animal genetics, statistics, and animal management. Cooperation with other departments, particularly the Department of Biology and the Department of Mathematics and Statistics, and collaboration with other research institutions, livestock producers, and commercial animal breeding companies broadens the resources of this graduate program.

*Course requirements:* Students in the MS program are required to complete the following courses: ADVS 6300, 6800; BIOL 6380; STAT 5110; and a minimum of 6 credits in the student's area of study. Students in the PhD program are required to complete the following courses in addition to those required for the MS degree: ADVS 6800, 6820; MATH 5710, 5720; STAT 6710, 6720.

## Molecular Biology

This specialization involves studies in molecular genetics, biochemistry of nucleic acids, cell biology, reproductive physiology, and bioveterinary science. Cooperation with other departments, particularly the Department of Biology and the Department of Chemistry and Biochemistry, the Biotechnology Center, and collaborators at other research institutions allows for a strong graduate program in this area.

*Course requirements:* Students in the MS program are required to complete the following courses: ADVS 5160 or 5240 or 5260; ADVS 6800; BIOL 5210 or 5220 or 6210; BIOL 5190; STAT 5200; and a minimum of 6 credits in the student's area of study. Students in the PhD program are required to complete the following courses in addition to those required for the MS degree: ADVS 6800; CHEM 5700, 5710.

## Reproductive Biology

This specialization involves studies in physiology and endocrinology of reproduction; embryo technology, including collection, culture, manipulation, storage, and transfer of embryos; disease transmission, cytogenetics and molecular genetics; and environmental and toxicological influences on reproductive processes and fetal development. Cooperation with other departments and research centers of the University and with USDA collaborators allows for a strong graduate program in this area.

*Course requirements:* Students in the MS program are required to complete the following courses: ADVS 6200, 6800; BIOL 5210, 5220; STAT 5200. Students in the PhD program are required to complete the following coursework additional to the MS requirements: ADVS 6800; BIOL 5150, 6210; CHEM 5700, 5710. Additional coursework for the MS and PhD degree may be required at the discretion of the supervisory committee.

## Animal or Dairy Management (MS only)

This specialization involves studies in the applications of the principles of genetics, reproductive biology, and nutrition to animal or dairy management at an advanced level. Appropriate emphasis is also placed on statistics, economics and business administration, and range management. The management specialization offers the option of degree programs with or without thesis (Plan A or Plan B). Graduates in management from a program including thesis (Plan A) may pursue advanced studies in more specialized fields. The MS in management without a thesis (Plan B) is considered a terminal degree.

*Course requirements:* Students choosing either the option with thesis (Plan A) or the option without thesis (Plan B) are required to complete the following courses: ADVS 6200, 6300, 6520 or 6530, 6800; plus one of the following (if comparable course not previously completed at the undergraduate level): ADVS 6080, 6090, 6120, 6130, 6190; one 5000-level Statistics course. Additional courses in related areas will be required as directed by the supervisory committee.

## Bioveterinary Science

This degree program involves studies in biochemistry, statistics, pathology, toxicology, virology, parasitology, pharmacology, and microbiology. Advanced techniques in laboratory procedures and animal health research are emphasized. Cooperation with other departments and research centers of the University and with federal collaborators and agencies allows for a strong graduate program in bioveterinary science.

*Course requirements:* Students in the MS program are required to complete the following courses: ADVS 6700, 6800; CHEM 5700; STAT 3000. Students in the PhD program are required to complete the following courses: ADVS 6700, 6800; CHEM 5700, 5710; STAT 5200. Additional coursework will be determined by the supervisory committee.

## Research

The ADVS department conducts a broad range of basic and applied research in the areas of animal reproduction, animal nutrition, livestock and dairy management, animal health, virology, parasitology, toxicology, animal behavior, cytogenetics, and molecular genetics. Department facilities include over 30 research laboratories on campus and at local and regional animal research facilities. There are research herds and flocks of beef and dairy cattle, sheep, and swine housed close to the University. There are additional research units housing beef cattle, sheep, and turkeys located throughout the state. Research in the department is funded by a multimillion dollar budget derived from support by the Utah Agricultural Experiment Station and by substantial outside contracts and grants. Cooperation with other departments and research centers of the University and with federal collaborators enhances the ADVS research and graduate programs. Significant in this regard are the University Center for Integrated BioSystems, the Utah State Animal Disease Diagnostic Laboratories, the Laboratory Animal Research Center, the Center for Environmental Toxicology, the Center for the Genetic Improvement of Livestock, and the on-campus USDA Poisonous Plant Laboratory.

## Financial Assistance

Both departmental and research grant support are available to matriculated graduate students on a competitive basis. The department funds a number of graduate assistantships, which are available on a competitive basis to matriculated graduate students who are U.S.

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citizens, nationals, or residents. Students interested in departmental assistantships may request an application form from the department. Applications for assistantships for the following academic year must be submitted by March 15.

Acceptance to graduate study in the ADVS Department does not constitute a guarantee of financial assistance.

## Career Opportunities

Career opportunities are available for students who have earned graduate degrees in the MS and PhD programs offered by the ADVS Department as described below.

### Animal and Dairy Science Graduate Degree Programs

#### Animal Nutrition

Career opportunities exist in extension, university and private research, the commercial animal feedstuffs industry, private consulting firms, and international programs.

#### Breeding and Genetics

Career opportunities exist in extension university and private research, commercial animal breeding and genetic engineering enterprises, and international programs.

#### Molecular Biology

Career opportunities exist in university, federal, and private research organizations, and in commercial applications in the rapidly growing area of biotechnology.

#### Reproductive Biology

Career opportunities exist in extension; university and private research; the pharmaceutical, embryo transfer, and artificial insemination industries; private consultation; and international programs.

#### Animal or Dairy Management

Career opportunities include extension, private consultation firms, farm and ranch management, sales and service to agricultural producers, agricultural finance, and international programs.

### Bioveterinary Science Graduate Degree Programs

Career opportunities in this area exist in research, management, and submanagement positions in public and private health research and testing organizations, and in commercial industries in the health field. Graduates from the MS program may seek admission to advanced degree programs in the biological sciences or veterinary medicine.

## Animal, Dairy and Veterinary Sciences Faculty

#### Trustee Professor

*Robert W. Sidwell*, virology

#### Professors

*Stanley D. Allen*, veterinary medicine, laboratory animal management  
*Clell V. Bagley*, veterinary medicine  
*Thomas D. Bunch*, cytogenetics, embryo biology  
*Noelle E. Cockett*, molecular genetics, identification of genetic markers  
*Roger A. Coulombe, Jr.*, veterinary toxicology, molecular biology  
*Howard M. Deer*, pesticides, environmental toxicology

*Mark C. Healey*, parasitology  
*Lyle G. McNeal*, sheep production, wool science  
*Kenneth L. White*, reproductive physiology, developmental biology

#### Research Professors

*John D. Morrey*, virology, transgenic animals  
*Kamal A. Rashid*, in vitro mutagenesis and DNA repair  
*Donald F. Smee*, viral chemotherapy

#### Adjunct Professors

*J. Talmage Huber*, dairy nutrition  
*Lynn F. James*, animal physiology  
*Amrit K. Judd*, medicinal chemistry as applied to treatment of viral diseases  
*Michael R. Marshall*, veterinary medicine  
*Kanok Pavasuthipaisit*, medical science, anatomy  
*R. Dean Plowman*, dairy genetics, management  
*Rex S. Spendlove*, microbiology

#### Professors Emeritus

*Clive W. Arave*, behavior, dairy genetics  
*John E. Butcher*, ruminant nutrition  
*Jay W. Call*, veterinary medicine  
*Warren C. Foote*, reproductive physiology  
*Robert C. Lamb*, dairy genetics  
*James LeGrande Shupe*, veterinary science, comparative clinical medicine  
*Ross A. Smart*, veterinary diagnostic pathology  
*Norris J. Stenquist*, livestock production, nutrition  
*Wallace R. Taylor*, dairy breeding, dairy herd improvement  
*Don W. Thomas*, veterinary medicine

#### Associate Professors

*Thomas J. Baldwin*, veterinary diagnostic pathology  
*Tilak R. Dhiman*, dairy nutrition  
*David D. Frame*, poultry production and management  
*Jeffery O. Hall*, veterinary pathology, toxicology  
*Kenneth C. Olson*, range livestock nutrition, management  
*Lee S. Rickords*, molecular genetics, developmental biology  
*Randall D. Wiedmeier*, beef cattle nutrition, management  
*Allen J. Young*, dairy management, reproduction  
*Dale R. ZoBell*, beef cattle production, management

#### Adjunct Associate Professors

*Dale R. Gardner*, chemistry/toxicology  
*Kip E. Panter*, animal science/toxicology  
*Roy W. Silcox*, physiology, nutrition  
*Bryan L. Stegelmeier*, pathology  
*John T. Stellflug*, reproductive physiology, biochemistry, statistics  
*J. Christopher Wilson*, veterinary medicine, fisheries

#### Associate Professor Emeritus

*Larry M. Slade*, equine nutrition, management

#### Research Associate Professor

*Dale L. Barnard*, virology

#### Adjunct Research Associate Professor

*Shiquan Wang*, cytogenetics, reproductive physiology

#### Assistant Professors

*Patricia A. Evans*, equine management  
*Ramona T. Skirpstunas*, bacterial diseases of fish, veterinary pathology, veterinary laboratory diagnostic medicine  
*Quinton A. Winger*, reproductive physiology, molecular biology

# Department of Animal, Dairy and Veterinary Sciences

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## Adjunct Assistant Professors

*Breck D. Hunsaker*, veterinary immunology  
*Stephen T. Lee*, analytical chemistry  
*Timothy A. McAllister*, ruminant nutrition, microbiology

## Research Assistant Professors

*Brian B. Gowen*, immunology, virology  
*Justin G. Julander*, virology, microbiology  
*Jeffrey L. Walters*, dairy cattle breeding, statistics

## Clinical Assistant Professor

*Rusty Stott*, clinical veterinarian, animal health

## Research Assistant Professor Emeritus

*Robert E. Warnick*, turkey nutrition

## Lecturers

*Brett R. Bowman*, animal science/nutrition  
*Parl Galloway*, animal science, manager of Animal Science Farm  
*Justin A. Jenson*, dairy herdsman coordinator, dairy youth specialist

## Course Descriptions

Animal, Dairy and Veterinary Sciences (ADVS), pages 551-555.