MICHIGAN STATE UNIVERSITY

Undergraduate Handbook 2013-2014
 Welcome .................................................................................................. 3
What is Animal Science ........................................................................... 3
The Animal Science Undergraduate Program ......................................... 4
Animal Science on the World Wide Web ................................................. 4
Special Service Requests ........................................................................ 4
Career Opportunities ............................................................................... 4
Academic Advising and Registration ...................................................... 6
Declaring or Changing Major to Animal Science .................................... 7
ANS Undergraduate Program Telephone Numbers ................................ 8
Financial Aid and Scholarships ............................................................... 9
Career Planning and Placement Information ......................................... 11
Student Employment ............................................................................. 12
Where To Get More Information ........................................................... 15
Student Clubs and Organizations .......................................................... 16
Intercollegiate Judging Teams ............................................................... 18
Extended Absence from Class .............................................................. 19
Academic Governance .......................................................................... 20
Professional Internships ....................................................................... 21
ANS Academic Programs ...................................................................... 22
Core Courses in Animal Science .......................................................... 23
Animal Industry Concentration ............................................................. 24
Animal Biology or Pre-Veterinary Medicine Concentration .................... 25
Companion & Exotic Animal Biology Concentration ............................... 26
Production Animal Scholars Concentration .......................................... 27
Coordinate Academic Opportunities-Lyman Briggs College................. 28
Coordinate Academic Opportunities-Midwest Poultry Consortium....... 28
Agriculture & Natural Resources Biotechnology Specialization .......... 28
Agribusiness Management Specialization ............................................ 30
Animal Science Description of Courses ................................................. 31
Agricultural Technology Programs ......................................................... 36
 Dairy Production .................................................................................. 37
 Beef Production .................................................................................. 39
 Horse Production ................................................................................ 41
 Swine Management ............................................................................. 43
Animal Science Faculty ......................................................................... 45
WELCOME

Welcome to the Animal Science Department at Michigan State University! We are looking forward to working with you over the next four years to help you build an exciting program that gives you plenty of opportunities and a chance to achieve your dreams. Our department has internationally renowned faculty who devote their careers to teaching, research, extension and public outreach related to animals. We have wonderful advisors who will help you make decisions that are tailored to your needs and interests. There are four concentrations in Animal Science from which you can choose. You have the opportunity to tailor your program by choosing the Animal Industries, Animal Biology or Pre-Veterinary Medicine, Companion and Exotic Animal Biology, or Production Animal Scholars concentration for your Bachelor of Science degree (B.S.) in Animal Science. For those of you enrolled in the Agricultural Technology program, options include Beef, Dairy, Horse, or Swine Management.

In our B.S. program, you will receive a strong science background along with many opportunities to work with animals. In our Agricultural Technology program, you will focus primarily on developing strong management skills. The Animal Science major will prepare you for the work force, graduate school, or veterinary school with a strong science background as well as practical experience. You will gain these experiences through learning in the classroom, working on our campus beef cattle, dairy cattle, horse, mink, poultry, and sheep farms as well as enjoying extra-curricular activities such as the Block and Bridle Club, the Animal Welfare team, the livestock judging teams, or you can join any of the hundreds of clubs available to MSU students. You can also participate in international experiences, internships, or work in a research lab to further your career goals. We have researchers working in reproductive and developmental biology, animal health and welfare, nutrient management, genomics, bioinformatics, and bone and joint health in beef cattle, swine, poultry and dairy animals. We are excited that you chose the Department of Animal Science at MSU as your “home” for the next four years. Please take advantage of opportunities to learn both inside and outside the classroom and we will do our best to make your experience at MSU memorable and the best ever!

Feel free to contact me if you need anything or have any questions: Dr. Janice Swanson, Chairperson, Department of Animal Science, 1290 Anthony Hall, swansoj@anr.msu.edu

WHAT IS ANIMAL SCIENCE

Throughout history, domestic livestock (cattle, sheep, goats, swine, poultry, and horses) have provided humans with a major source of food, fiber, pleasure, and companionship. Over the last century, advances in animal feeding, breeding, reproduction, and management techniques occurred simultaneously with improvement in other agricultural practices.

The rate of technological innovations in animal agriculture has accelerated in the last 20 years. Computers are revolutionizing animal production, research, and marketing capabilities. Alternate feed sources have been identified; estrus synchronizing agents have been discovered; embryo transfer techniques have been developed, and new growth promoting compounds are being tested. Molecular geneticists are unraveling the complexities of mammalian genes and the field of biotechnology is maturing. Research focused on immunology and animal behavior offer new insight into ways of enhancing animal welfare.

Animal Science is an exciting field that has application to all animals and provides opportunities from production through agribusiness and processing. It can provide a solid foundation for veterinary medicine, other professional schools, or graduate school. We believe a degree in Animal Science at Michigan State University prepares you well for your future career path.
THE ANIMAL SCIENCE UNDERGRADUATE PROGRAM

The undergraduate program in animal science, which leads to the Bachelor of Science degree, is designed to prepare students for a variety of career opportunities. Scientific principles of biology and animal agriculture developed from various animal models are an important component of the animal sciences program. Another important component is the application of animal management procedures in agricultural operations.

The animal science major provides students much flexibility in meeting their program requirements. Students can benefit most from this flexibility with careful guidance from their academic advisors and career mentors as they plan programs of study consistent with their interests and goals. To gain the most from advisors, we encourage each student to see their advisor or mentor once per semester to discuss course selection, career objectives, and any other concerns or items relevant to the student.

All students in animal science must complete required core courses involving the disciplines of breeding and genetics, nutrition, physiology, and management. These principles are taught utilizing beef and dairy cattle, horses, poultry, sheep, and swine. Students must also complete one of the four concentrations in Animal Science.

ANIMAL SCIENCE ON THE WORLD WIDE WEB

The home page for the Department is www.ans.msu.edu. Information on courses, clubs & teams, scholarships, internships, etc. can be found in the undergraduate section. Other resources can be found on the MSU home page, www.msu.edu. Click on Info for Students and this will take you to Academic Programs, Descriptions of Courses, and Schedule of Courses. All of the information will be helpful in planning your academic program.

SPECIAL SERVICE REQUESTS

Persons with special needs or disabilities may request accommodations for Animal Science classes by calling John Shelle (355-8391) or Tracy Rich (353-9227) at least 10 days before the start of each semester to ensure sufficient time to make arrangements. Requests received after this date will be met, but timing is not guaranteed.

CAREER OPPORTUNITIES IN ANIMAL SCIENCE AND RELATED INDUSTRIES

The United States Department of Agriculture reported that more than 48,000 jobs will be created annually for college graduates with expertise in agriculture and related industries. The livestock industry and related fields are a major component of the United States economy and career opportunities are excellent for students trained in animal science.

ANIMAL PRODUCTION/MANAGEMENT

Livestock producers are concerned with production of cattle, sheep, goats, horses, swine, and poultry. These individuals and the people they employ are the cornerstone of the animal industry. They must be superb business people and be knowledgeable in animal products, nutrition,
genetics, behavior, and physiology. In addition, they must know how to manage livestock, have marketing expertise, and understand the relationships between the environment, communities and agriculture.

FOOD PROCESSING
The food processing industry is a major employer of animal science graduates. This segment of the industry not only is concerned with marketing meat, milk, and eggs in the usual sense, it is also involved in fabrication of new products, production of specialty food items, and development of products that will appeal to a health-conscious public. This progressive component of animal agriculture hires animal science graduates as livestock buyers, quality control specialists, plant managers, and sales personnel.

ANIMAL FEED/HEALTH INDUSTRY
Pharmaceutical organizations, livestock product companies, and feed companies are constantly seeking bright, energetic young people to enter research groups, sales forces, and consulting agencies dealing with both commercial livestock production and companion animals.

VETERINARY MEDICINE
A baccalaureate degree in ANS provides the foundation in science needed to apply to a college of veterinary medicine. In fact, there are two concentrations in ANS that are designed for this purpose: Animal Biology and Pre-Veterinary Medicine or Production Animal Scholars. Admission into a college of veterinary medicine is very competitive. So, students should strive to academic excellence and concurrently develop an alternative career plan while striving to enter veterinary college.

COMMUNICATION AND SERVICE ORGANIZATIONS
Breed associations, livestock commodity groups, artificial insemination services, and government agencies employ animal science students as representatives of their organizations. Likewise, livestock publications, newspapers, television stations, advertising agencies, and public relations firms need talented people who can communicate about agriculture. Other service organizations such as banks, insurance companies, real estate agencies, and power companies also employ agricultural representatives.

RESEARCH
Research designed to improve efficiency and quality of domestic animals and to solve livestock-related problems is conducted by a number of agencies including the U.S. Department of Agriculture (USDA), universities, and private companies. Individuals with bachelors and masters degrees can work in laboratory research or continue on for their doctoral degree. There are numerous opportunities for students to conduct and manage a research program and to teach. With recent advances in computer science and biotechnology, individuals skilled in these areas will become even more competitive.

EDUCATION AND EXTENSION
A student majoring in animal science may qualify to teach vocational agriculture in high school under a program of study cooperatively developed by the Department of Community Sustainability. Animal science majors may also find employment with the Cooperative Extension Service working as a county agent. People with advanced degrees in animal science are needed to teach in colleges and universities. All of these teaching fields will require animal science graduates to meet the needs of the future.

Animal agriculture is a huge component in the American economy. It not only involves livestock production, but also encompasses marketing, public affairs, transportation, processing, research, companion animal management, and a myriad of allied specialties. Animal science is a challenging field with many employment opportunities.
ACADEMIC ADVISING AND REGISTRATION

Each student is responsible for knowing the university, college, and department requirements as stated in the MSU Academic Programs. Students must complete the graduation requirements that were in effect at the time the student entered the ANS major unless he/she elects to complete a curriculum adopted by the ANS department at a later time.

Each freshman or transfer student will be assigned an academic advisor in ANS during the Academic Orientation program (AOP). In addition to an academic advisor, students are encouraged to select another ANS faculty member as a career mentor. This person can provide guidance on career paths and internships.

You should not rely solely on Degree Navigator and perform “self advising”. Historically students who operated strictly with Degree Navigator and do not work with an advisor have made critical errors that delayed graduation or they missed opportunities to enhance their programs. Further, these students may not become acquainted with the faculty and faculty may not become acquainted with these students. See your advisor regularly!

If you are not satisfied with the advisor to whom you were assigned, it is your option to select a new advisor. No explanation is required and nobody has hurt feelings. Remember, this is your academic program. If you change advisor, please inform Tracy Rich (richt@msu.edu).

All ANS students are encouraged to see their advisor at least once per semester to review their academic progress toward graduation and professional goals. Your advisor must also certify your completion of all requirements for graduation.

It is critical to keep your advisor and mentor informed about your actions and plans. Let him/her know if you are available for specialized independent educational and work experiences. Frequent short meetings are better than one long meeting. Remember, one of the most important people in your MSU undergraduate program of study is your advisor. Effective communication with your instructors and advisor will enhance your program of study, progress, and career after graduation.

GRADUATION REQUIREMENTS FOR A BACHELOR’S DEGREE*

To be recommended for a bachelor's degree, a student must complete all of the following:

- Complete one year's work, normally the year of graduation, earning at least 30 credits in courses given by Michigan State University. A senior who has earned sufficient credits from this university and met the minimum requirements as stated below, through prior arrangement with the assistant dean of the college and the registrar, may be permitted to transfer not to exceed 10 of the last 30 credits from an accredited 4-year college or university.

- Earn at least 27 credits on the East Lansing campus after reaching junior standing.

- Complete at least 20 credits at Michigan State University while enrolled in the major in the college in which the degree is to be earned.

- Remove any deficiencies identified by MSU placement test scores, as described in the Academic Placement Tests and Remedial-Development-Preparatory courses sections of the MSU Academic Programs Announcement.

- Complete the University requirement of 30 credits in courses approved for integrative studies or in approved substitutes, as described in the Integrative Studies section of the
MSU Academic Programs Announcement.

- Complete satisfactorily an approved program of study in a college.
- Complete a minimum of 120 credits (123 credits if Math 1825 is taken) with average grade point of at least a 2.00.

SEQUENCE FOR REGISTRATION
1. Review program progress; prepare tentative schedule; review questions and options.
2. Schedule advisor appointment. If you do not know your advisor, check with Tracy Rich (richt@msu.edu or 517-353-9227 in room 1250 Anthony Hall. Tracy has a master list of students and their advisors assigned at Academic Orientation.
3. Prepare tentative schedule with several alternatives to discuss with your advisor during scheduled appointment.
4. Meet with your advisor.
5. Enroll via computer enrollment.
6. At MSU, students enroll for the entire academic year which is fall and spring semesters at once.
7. When computer enrollment is complete, you are registered.
8. The Registrar’s Office will mail you a completed schedule and fee statement.

COURSES AT OTHER INSTITUTIONS
To determine if courses taken or to be taken at other institutions transfer as course credits to MSU.

Step 1. On the internet go to: http://transfer.msu.edu/Institution.asp

Step 2. Select the college or university.

Step 3. Select an appropriate course category.

Step 4. Determine if the course has an equivalent course at MSU.

Step 5. Review requirements at MSU to be sure transferred course meets requirement.

MSU students enrolling in a course at another institution should complete a guest status form to ensure that the credits will transfer to MSU. These forms are available in the CANR Academic and Student Affairs office in 121 Agriculture Hall.

DECLARING OR CHANGING MAJOR TO ANIMAL SCIENCE
Students who enter MSU with no declared major enter the University Undergraduate Division (UUD). After deciding to major in ANS, students who are freshmen or sophomores must contact UUD in the area of their residence hall to declare their major as ANS. Students above sophomore status must contact Kathy Delaney at delaney@msu.edu or 517/355-0234 in 121 Agriculture Hall.
# ANIMAL SCIENCE UNDERGRADUATE PROGRAM

## E-MAIL ADDRESSES & TELEPHONE NUMBERS

### UNDERGRADUATE STUDENT OFFICE (1250 Anthony Hall)

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Office Location</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Shelle</td>
<td>Undergraduate Program Coordinator</td>
<td>1250 Anthony</td>
<td><a href="mailto:shelle@msu.edu">shelle@msu.edu</a></td>
<td>355-8391</td>
</tr>
<tr>
<td>Tracy Rich</td>
<td>Secretary</td>
<td></td>
<td><a href="mailto:richt@msu.edu">richt@msu.edu</a></td>
<td>353-9227</td>
</tr>
<tr>
<td>John Shelle</td>
<td>Internship Coordinator</td>
<td></td>
<td><a href="mailto:shelle@msu.edu">shelle@msu.edu</a></td>
<td>355-8391</td>
</tr>
</tbody>
</table>

### ADVISORS FOR BACCALAUREATE PROGRAM

<table>
<thead>
<tr>
<th>Name</th>
<th>Field</th>
<th>Office Location</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard Balander</td>
<td>Poultry, Pre Vet</td>
<td>1250 Anthony</td>
<td><a href="mailto:balander@msu.edu">balander@msu.edu</a></td>
<td>432-1395</td>
</tr>
<tr>
<td>Roy Fogwell</td>
<td>Prod Anml Sch</td>
<td>1250 Anthony</td>
<td><a href="mailto:fogwell@msu.edu">fogwell@msu.edu</a></td>
<td>432-1385</td>
</tr>
<tr>
<td>Gretchen Hill</td>
<td>Swine/Beef Sch</td>
<td>2290 Anthony</td>
<td><a href="mailto:hillgre@msu.edu">hillgre@msu.edu</a></td>
<td>355-9676</td>
</tr>
<tr>
<td>Elizabeth Karcher</td>
<td>Dairy</td>
<td>1287 Anthony</td>
<td><a href="mailto:ekarcher@msu.edu">ekarcher@msu.edu</a></td>
<td>353-8518</td>
</tr>
<tr>
<td>Brian Nielsen</td>
<td>Horse</td>
<td>1287 Anthony</td>
<td><a href="mailto:bdn@msu.edu">bdn@msu.edu</a></td>
<td>432-1378</td>
</tr>
<tr>
<td>John Shelle</td>
<td>Horse</td>
<td>1250 Anthony</td>
<td><a href="mailto:shelle@msu.edu">shelle@msu.edu</a></td>
<td>355-8391</td>
</tr>
<tr>
<td>Karen Waite</td>
<td>Horse</td>
<td>1287 Anthony</td>
<td><a href="mailto:kwaite@msu.edu">kwaite@msu.edu</a></td>
<td>353-1748</td>
</tr>
<tr>
<td>Miriam Weber Nielsen</td>
<td>Dairy</td>
<td>1250 Anthony</td>
<td><a href="mailto:msw@msu.edu">msw@msu.edu</a></td>
<td>432-5443</td>
</tr>
<tr>
<td>Sarah Wells Nielsen</td>
<td>Meats</td>
<td>3385 Anthony</td>
<td><a href="mailto:wellssa@msu.edu">wellssa@msu.edu</a></td>
<td>355-8552</td>
</tr>
</tbody>
</table>

### ADVISORS FOR AGRICULTURAL TECHNOLOGY

<table>
<thead>
<tr>
<th>Name</th>
<th>Field</th>
<th>Office Location</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dennis Banks</td>
<td>Beef</td>
<td>1250 Anthony</td>
<td><a href="mailto:banks@msu.edu">banks@msu.edu</a></td>
<td>355-4704</td>
</tr>
<tr>
<td>Joe Domecq</td>
<td>Dairy</td>
<td>1250 Anthony</td>
<td><a href="mailto:domecqjo@msu.edu">domecqjo@msu.edu</a></td>
<td>353-7855</td>
</tr>
<tr>
<td>Camie Heleski</td>
<td>Horse</td>
<td>1250 Anthony</td>
<td><a href="mailto:heleski@msu.edu">heleski@msu.edu</a></td>
<td>355-8427</td>
</tr>
<tr>
<td>Dennis Banks</td>
<td>Swine</td>
<td>1250 Anthony</td>
<td><a href="mailto:banks@msu.edu">banks@msu.edu</a></td>
<td>355-4704</td>
</tr>
</tbody>
</table>

### STUDENT CLUBS AND FARM UNITS

<table>
<thead>
<tr>
<th>Club</th>
<th>Location</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avian Science Club</td>
<td>1250</td>
<td></td>
<td>432-1395</td>
</tr>
<tr>
<td>Block &amp; Bridle Club</td>
<td>1275</td>
<td></td>
<td>353-5182</td>
</tr>
<tr>
<td>Dairy Club</td>
<td>1272</td>
<td></td>
<td>355-3699</td>
</tr>
<tr>
<td>Rodeo Club</td>
<td>1264</td>
<td></td>
<td>432-6760</td>
</tr>
<tr>
<td>Horsemen’s Association</td>
<td>1265</td>
<td></td>
<td>432-2425</td>
</tr>
<tr>
<td>Equestrian Team</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polo Team</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dressage Team</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef Cattle Research Ctr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy Cattle Research &amp; Teaching</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purebred Beef Barn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swine Teaching &amp; Research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horse Teaching &amp; Research Ctr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poultry Teaching &amp; Rsrch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep Teaching &amp; Rsch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Pavilion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Office of Financial Aid, located in Room 259 Student Services (353-5940), distributes more than 60 million dollars in financial assistance to over 50% of the MSU student population. A number of scholarship, loan, grant, and work study packages are available for students who inquire.

Listed below are scholarships for which ANS students may be eligible. Some applications are available in the ANS Undergraduate Student Affairs Office in Room 1250 Anthony Hall. Others are available at the address or web site provided. Students will be notified via email when available scholarships come into the Department Undergraduate Office. Additional scholarships may be available through the College of Agriculture and Natural Resources Academic and Student Affairs Office in 121 Ag Hall (355-0234).

A. Scholarships for 4-Year Students in Animal Science

Richard and Dana Balander Avian Scholarship
This scholarship will award up to $1500 dollars to honor and encourage students pursuing a poultry or avian species related career. Academic performance, leadership attributes, career ambitions and financial need will be considered by the selection committee. Undergraduate students will receive primary consideration, but graduate students are also encouraged to apply. Applications are available in spring semester in 1250 Anthony Hall. Deadline is May 15 for completed applications.

Howard E. Cowles Dairy Prize
Awarded annually to juniors born in Michigan and who are majoring in Animal Science with an interest in dairy. Students must also exhibit interest and participation in extracurricular dairy activities. Recipients are selected by the faculty of Animal Science from students who meet criteria for eligibility.

Michigan Dairy Memorial Scholarships
Tuition scholarships of $1,500/year for freshmen or $3,500/year to full tuition and fees for sophomores, juniors and seniors are available to students preparing for careers in the dairy industry. Applications are available in 1250 Anthony Hall. Deadline for completed applications is September 27 for freshmen and February 28 for sophomores, juniors and seniors.

Jack and Betty Barnes International Michigan Dairy Memorial Scholarship
A tuition scholarship of $1,000 is available to students meeting eligibility criteria for Michigan Dairy Memorial Scholarships and who desire an international experience to enhance their education. Applications are available in 1250 Anthony Hall. Deadline for completed applications is April 1.

Michigan Livestock Industry Scholarships
Awards of $2,000/year are available to students preparing for careers in the livestock industry. Applications are available in 1250 Anthony Hall. Deadline is February 1 for completed applications.

Michigan Pork Producers Association Scholarship
**Ralph Hudson Scholarship**
A $250 cash award is given to the Outstanding Block and Bridle Club member selected by the faculty in Animal Science.

**Reginald A. Emmert Scholarship**
Awards for $1,000 per year are available to full time ANS undergraduates with an emphasis in livestock production. Applications are available in 1250 Anthony Hall.

**Harry Moxley Scholarship**
A $250 cash award is given to the outstanding junior in Animal Science with a livestock emphasis. The recipient is selected by faculty in Animal Science.

**B. Scholarships for Students Enrolled in The Institute of Agricultural Technology**

**Michigan Milk Producers Association Scholarship**
Eight awards are presented annually to Ag Tech Dairy Management students interested in pursuing careers in dairy farming. Recipients must be MMPA members, or children or employees of members. Applications are available in 1250F Anthony Hall. Deadline for completed applications is September 15.

**Michigan Dairy Memorial Scholarship Foundation, Inc, Scholarships**
Tuition scholarships of $1,500/year are available to Ag Tech students preparing for careers in dairy science, processing, and/or manufacturing. Applications are available in 1250 Anthony Hall. Deadline is September 30 for completed applications. Applications are available in 1250 Anthony Hall.

**C. Additional regional or national scholarships**

**The Chicago Mercantile Exchange (CME) Pork Industry Scholarship**
Four $2,500 scholarships will be awarded to students who intend to pursue a career in the pork industry - talented and thoughtful students who may emerge as industry leaders someday.

One of the top four winners will receive an all expense paid trip to the Pork Industry Forum.

1. Be an undergraduate student in a two-year swine program or a four-year college of agriculture;
2. Write a brief letter indicating what role you see yourself playing in the pork industry after graduation;
3. Submit an essay of 750 words or less describing an issue you see confronting the pork industry today or in the future - and offer your solutions;
4. Obtain two letters of reference from current or former professors or industry professionals;
5. Prepare a cover sheet with your:
   A - name
   B - complete mailing address and telephone number
   C - school name
   D - year in school
   E - permanent mailing address and telephone number
   F - social security number
Remember, you need to be actively engaged in finding a job. The job will not come to you.

Part-Time Jobs While in College and Summer Employment
The above resources should be contacted with respect to summer and part-time employment. However, the general policy is to centralize these opportunities at the Student Employment Office in the Student Services Building.
STUDENT EMPLOYMENT AT DEPARTMENTAL FARMS AND FACILITIES

The Department of Animal Science provides additional learning opportunities in several ways. ANS students supplement their educational programs with part-time departmental employment. Students work in offices, research labs, and farms on campus. These types of employment provide valuable training and technical skills that enhance student learning while providing much needed financial support.

Working in ANS research labs is an interesting and challenging job for the science-oriented student. Each lab offers a unique experience. Some of the areas in which animal science research is being conducted are ruminant or monogastric nutrition; physiology; endocrinology; toxicology; animal behavior; meats, and molecular biology. There is something of interest for most students desiring more information regarding animal research or laboratory science.

The departmental livestock farms, located on the south side of campus, present a unique learning situation for the ANS students. Students provide most of the labor force involved in the daily care and maintenance of MSU livestock. This type of hands-on learning is proven an invaluable experience for students interested in production animal agriculture.

**Beef Cattle**

There are two ANS beef facilities that employ students.

The Beef Cattle Research Center (BCRC) is an automated feedlot with a capacity of approximately 700 head. Students gain experience in the feed and care of the beef market animal and first hand knowledge of large scale animal research.

**Manager: Ken Metz 353-2245 metz@msu.edu**

The Purebred Beef Cattle Teaching Center gives students a perspective of a different segment of the beef cattle industry. Approximately 50 Angus cows are used to demonstrate cow/calf management, pasture management, livestock marketing, fitting and showing, artificial insemination, embryo transfer, and beef cattle breeding at this unit.

**Manager: Ken Metz 355-7452 metz@msu.edu**

**Dairy Cattle**

The dairy industry is the leading animal industry in Michigan and offers tremendous employment opportunities for the Animal Science graduate. The Dairy Cattle Teaching and Research Center plays an important role in training dairy students both in the classroom and by employing students on the farm. This facility houses approximately 380 head and milks about 175 head of Holsteins. Students become involved in all facets of dairy cattle management as well as research trials that are a major part of the responsibility of this unit.

**Manager: Bob Kreft 355-7443 kreft@msu.edu**

**Horses**

The Horse Teaching and Research Center functions primarily to provide hands-on classroom experience for students interested in horses. This facility houses approximately 90 head of Arabian horses and stands stallions for breeding. Student employees are responsible for care of horses and facilities and become directly involved in foaling, breeding, and management. Young horses are trained and shown by student employees during the spring and summer. The horse center provides students the opportunity to apply classroom knowledge in the farm setting.

**Manager: Paula Hitzler 355-7484 phitzler@msu.edu**
**Poultry and Mink**
A 9,000 bird laying house and mink ranch, and numerous poultry research projects on one facility afford students an animal experience. The mechanization and integration of the poultry industry demands well trained and knowledgeable personnel. The poultry unit provides an introduction to this industry as well as giving students the opportunity to learn new skills in nutrition and management by working with poultry and small carnivores. Animal research to investigate the effects of toxic chemicals in the environment is currently being explored at this facility. These are exciting fields in animal science.

**Manager:** Angelo Napolitano 355-0360 mapolit3@msu.edu

---

**Sheep**
The Sheep Teaching and Research Center houses outstanding flocks of Suffolk, and commercial sheep. Student employees work in all aspects of sheep management with 150 sheep. Feeding, shearing, fitting and showing, foot care, lambing, breeding, castrating, and docking are all part of the learning opportunities at the sheep unit.

**Manager:** Alan Culham 355-7477 culhama@msu.edu

---

**Swine**
The Swine Teaching and Research Center farrows approximately 300 sows and finishes about 2,000 market hogs/year. Many of these animals are part of teaching exercises and ongoing research studies. The swine farm gives students a wide range of experiences and offers a wealth of information and learning about nutrition, genetics, and modern swine farm management.

**Manager:** Kevin Turner 355-7485 turner67@msu.edu

---

**Meats Laboratory**
The MSU Meat Laboratory in Anthony Hall, completed in fall, 1998, is one of the most modern meat processing facilities on any U.S. college campus. It is designed for processing cattle, poultry, sheep, and swine into meat and processed meat products. It contains facilities for slaughtering, chilling, cutting and further processing. The sausage kitchen is equipped with all major processing equipment scaled down for laboratory-sized meat formulations plus refrigerated curing rooms and a smokehouse.

The meat industry offers a multitude of opportunities for the interested Animal Science graduate. Employment in the Meats Laboratory allows students to gain valuable knowledge that cannot be obtained elsewhere. Students interested in careers in meat science find this experience to be irreplaceable.

**Manager:** Jennifer Dominguez 432-0845 ext. 199 doming21@msu.edu

---

**Livestock Judging Pavilion - The Pavilion for Agriculture and Livestock Education**
This facility has a large arena, auditorium, exhibition area and four classrooms. Many animal laboratories conducted on campus are held at “The Pavilion”. Students working there assist with the set-up and delivery of many of these laboratories. The Michigan animal industry also makes use of this facility for livestock shows, sales, and displays. Working at “The Pavilion” provides a chance to become acquainted with many different faculty members and industry persons and gain knowledge about a variety of animals.

**Manager:** Scott Rancour 432-5566 rancour2@msu.edu
Animal Air Quality Research Facility
The impact of animals on the environment is a vital area study and gaining importance around the world. The Animal Air Quality Research Facility (AAQRF), was constructed specifically for the purpose of studying air quality issues related to animal production, including the impact of animal diets on gaseous emissions. The laboratory consists of 12 animal rooms, each with interchangeable penning and watering systems. Penning, feed and water handling systems, and manure handling apparatus for each species in removable from the chambers in order to accommodate the needs of different species. Each room can accommodate one horse, one lactating cow, two growing heifers, six finishing pigs, 20 turkeys, 60 broiler chickens, or 80 laying hens. Students at AAQRF have the opportunity to improve animal husbandry skills and gain intensive research experience.
Faculty Coordinator: Wendy Powers 432-3849  wpowers@msu.edu
WHERE TO GET MORE INFORMATION
FOCUSED ON SCIENTIFIC DISCIPLINES OR SPECIES

<table>
<thead>
<tr>
<th>Subject Groups</th>
<th>Contact Person</th>
<th>Phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellular Reprogramming</td>
<td>Dr. J. Cibelli</td>
<td>432-7065</td>
</tr>
<tr>
<td>Molecular Genetics</td>
<td>Dr. C. Ernst</td>
<td>355-8452 ext. 210</td>
</tr>
<tr>
<td>Molecular Virology</td>
<td>Dr. P. Coussens</td>
<td>353-7291</td>
</tr>
<tr>
<td>Reproductive Biology</td>
<td>Dr. G. Smith</td>
<td>432-1456</td>
</tr>
<tr>
<td></td>
<td>Dr. J. Ireland</td>
<td>432-1384</td>
</tr>
<tr>
<td></td>
<td>Dr. R. Pursley</td>
<td>432-6178</td>
</tr>
<tr>
<td>Horse Research</td>
<td>Dr. B. Nielsen</td>
<td>353-4866</td>
</tr>
<tr>
<td>Non-Ruminant Nutrition</td>
<td>Dr. N. Trottier</td>
<td>353-4867</td>
</tr>
<tr>
<td></td>
<td>Dr. G Hill</td>
<td>355-9676</td>
</tr>
<tr>
<td>Forage Nutrition</td>
<td>Dr. M. Allen</td>
<td>432-1457</td>
</tr>
<tr>
<td>Ruminant Nutrition</td>
<td>Dr. S. Rust</td>
<td>355-3802</td>
</tr>
<tr>
<td></td>
<td>Dr. M. Allen</td>
<td>432-1386</td>
</tr>
<tr>
<td></td>
<td>Dr. D. Buskirk</td>
<td>432-0400</td>
</tr>
<tr>
<td>Ruminant Metabolism</td>
<td>Dr. M. Vanderhaar</td>
<td>432-1454</td>
</tr>
<tr>
<td></td>
<td>Dr. M. Weber Nielsen</td>
<td>432-5443</td>
</tr>
<tr>
<td>Lipid Research</td>
<td>Dr. Adam Lock</td>
<td>353-9729</td>
</tr>
<tr>
<td>Toxicology</td>
<td>Dr. S. Bursian</td>
<td>432-1382</td>
</tr>
<tr>
<td>Poultry Research</td>
<td>Dr. D. Karcher</td>
<td>775-0485</td>
</tr>
<tr>
<td>Animal Behavior</td>
<td>Dr. J. Swanson</td>
<td>432-4134</td>
</tr>
<tr>
<td></td>
<td>Dr. J. Siegford</td>
<td>432-1388</td>
</tr>
<tr>
<td></td>
<td>Dr. C. Heleski</td>
<td>355-8427</td>
</tr>
<tr>
<td>Statistics and Biometrics</td>
<td>Dr. D. Banks</td>
<td>355-4704</td>
</tr>
<tr>
<td></td>
<td>Dr. R. Bates</td>
<td>432-1387</td>
</tr>
<tr>
<td></td>
<td>Dr. J. Steibel</td>
<td>353-5102</td>
</tr>
<tr>
<td></td>
<td>Dr. R. Tempelman</td>
<td>355-8445</td>
</tr>
<tr>
<td>Developmental Epigenetics</td>
<td>Dr. Jason Knott</td>
<td>432-7498</td>
</tr>
</tbody>
</table>

Livestock

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Contact Person</th>
<th>Phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Cattle &amp; Research Center</td>
<td>Mr. Ken Metz</td>
<td>353-2245</td>
</tr>
<tr>
<td>Dairy Teaching &amp; Research Center</td>
<td>Mr. Bob Kreft</td>
<td>355-7473</td>
</tr>
<tr>
<td>Horse Teaching &amp; Research Ctr.</td>
<td>Ms. Paula Hitzler</td>
<td>355-7484</td>
</tr>
<tr>
<td>Poultry &amp; Mink Research Center</td>
<td>Mr. Angelo Natpolitano</td>
<td>355-0360</td>
</tr>
<tr>
<td>Purebred Beef Barn</td>
<td>Mr. Ken Metz</td>
<td>355-7452</td>
</tr>
<tr>
<td>Sheep Teaching &amp; Research Ctr.</td>
<td>Mr. Al Culham</td>
<td>355-7477</td>
</tr>
<tr>
<td>Swine Teaching &amp; Research Ctr.</td>
<td>Mr. Kevin Turner</td>
<td>355-7485</td>
</tr>
<tr>
<td>The Pavilion</td>
<td>Mr. Scott Rancour</td>
<td>432-5566</td>
</tr>
<tr>
<td>Meats Laboratory</td>
<td>Ms. Jenny Dominguez</td>
<td>432-0845 x 199</td>
</tr>
</tbody>
</table>
STUDENT CLUBS, ORGANIZATIONS, AND ACTIVITIES

Five campus-wide student clubs, which are open to all MSU students, are affiliated with the Department of Animal Science. These are: Block and Bridle, Dairy Science, Avian Science, Rodeo Club and the Horseman’s Association (Equestrian Team, Dressage, Polo), and Driving Clubs. Each organization offers students the opportunity to cultivate their leadership and communication abilities with students having similar interests and concerns. Animal Science faculty serve as the club advisors and are support club functions and events. The department recommends that students be actively engaged one or more of these organizations. Further information for each club can be obtained at the Animal Science website in the undergraduate section: www.ans.msu.edu

Academic Quadrathalon
In addition to student clubs, the ANS department sponsors an academic competition for students. Academic Quadrathalon consists of a written exam, oral presentation, laboratory practicum, and quiz bowl.

Teams of four students compete for state honors with the first place team representing MSU at the regional American Society of Animal Science meetings during the Spring semester. Academic Quadrathalon is a great opportunity to your knowledge in all areas of Animal Science. It is an excellent learning experience and enjoyable for all who participate.

Animal Science Undergraduate Research Student Association (ASURSA)
The primary objective for ASURSA is to provide opportunities for students to participate actively in research. Students may get involved in group projects or associate with one faculty and perform more independent research. Activities can include planning, funding, conducting the methods, laboratory work, analysis of data, presentation, and publication. Advisors for ASURSA are Dr. Nathalie Trottier at 432-5140 or trottier@msu.edu and Dr. Liz Karcher at 353-8518 or ekarcher@msu.edu

Block and Bridle Club
Block and Bridle sponsors many events that provide learning opportunities for students through meaningful, hands-on participation. The Little International brings students from all majors together to compete for the coveted Jack MacAllen Award given to the best overall livestock showperson. University animals are prepared by each participant with the novice receiving help and guidance from the more experienced club members in a spirit of fellowship and competition.

Another purpose of the Block and Bridle Club is to promote and maintain student contact with the Michigan livestock industry. Each year the club sponsors the Block and Bridle Recognition Banquet which honors Animal Science students and alumni. They also recognize an Honored Guest who has made a significant contribution to the Michigan livestock industry.

The Block and Bridle Club students volunteer time to work with the livestock industry, at various events throughout the year. Each spring the club organizes and manages the Junior Steer and Heifer Show at the MCA Beef Expo, attracting youth exhibitors from the tri-state area. In June they host the Northern Exposure Lamb Show.

In addition to these club-sponsored activities, members participate in other college and university events such as Autumnfest, Small Animal Days, and Ag Olympics. An annual trip to the national meetings allows members to interact with students from other universities. The Block and Bridle Club is a worthwhile and rewarding opportunity for students that provide social, personal, and academic growth for all its members.
The Michigan dairy industry is one of the largest in the nation, creating the need to educate and train dairy students at Michigan State. Many of the students in the Dairy Club will have active roles in the Michigan dairy industry in the near future in production or agri-business. In addition to the social and educational activities of the MSU Dairy Club, the club has two primary purposes. The first is to promote the dairy industry and the second is to increase the contact between the members of the Dairy Club and the Michigan dairy industry.

The annual Christmas Cheese Sale has been a tradition of the club for many years, providing quality dairy products that make great holiday gifts! In addition, the Dairy Club is a co-sponsor for the calf sale in the spring. These business activities provide students with experience not obtainable in the classroom and, at the same time, promotes dairy products and provide visibility for MSU.

The annual Recognition Banquet serves to bring students, alumni, dairy industry organizations, parents, and dairy farmers together to recognize the efforts of outstanding students, alumni, and industry leaders. The interaction of these groups serves an important function for Michigan’s dairy industry.

Annually, over 20,000 consumers and 5,000 producers have been reached through the combined activities of the MSU Dairy Club. The officers, club members, and alumni can be proud of their organization and accomplishments. Our industry can be proud of these students who are the future of the Michigan Dairy Industry.

The MSU Horsemen’s Association is designed for all those interested in the horse industry. The Horsemen’s Association objectives and purpose are educating the community and the MSU student body about horses and the horse industry; promoting horses and the horse industry; providing educational and social opportunities for MSU students interested in horses; providing the opportunity for members to participate in industry-wide activities; creating enriching experiences that expand knowledge and broaden perspectives of the horse industry; serving as a liaison between students at MSU, local horse industries, and university faculty, staff, and administration; Stimulating interest in horse related professions for future horse industry leaders. To participate on the “MSU Equestrian Team”, “MSU Dressage Team”, or the “MSU Polo Club” a student must be a member of the Horsemen’s Association which provides financial support to all groups.

The MSU Driving Club originated in 2004 in response to an increased interest among students in draft horses and driving horses in general. The goals of the MSU Driving Club are to promote the driving of horses at MSU and in the community. We aspire to support and revive the heritage of draft horses through participation in community service with draft horses. We appreciate and try to build continued support for the MSU Draft Horse Endowment Fund.

Club activities focus on draft horse driving at the MSU Horse Teaching and Research Facility and the Great Lakes International Draft Horse Show and Pull. Club members have hands-on opportunities with the MSU Draft Horses and volunteer opportunities within the draft horse industry.
Avian Science Club
The MSU Poultry Science Club is open to all MSU students, undergraduates, and graduates. An interest in poultry or other avian species is desirable, but not required. The club has both social and professional attributes. Students can attend the annual trip to the Southeastern Poultry Convention each January in Atlanta, GA where many of the members have successfully interviewed with several dozen companies. Other activities include a summer camping and canoe trip on one of Michigan's rivers, a team in the Ag Olympics, a spring trip which has included Toronto and Eli Lilly in Indianapolis, participation in Autumnfest, and the poultry farm exhibits for Small Animals Day each April. Club goals are to promote leadership, friendship, participation in activities, and promotion of poultry and animal science. The club has recently initiated a turkey sale for Thanksgiving. They rear the birds at the Poultry Teaching and Research center and process them at the MSU Meats Laboratory.

Rodeo Club
The MSU Rodeo Club originated in 1969 and is a member of the National Intercollegiate Rodeo Association (NIRA). Its goal is to encourage further education through the promotion of collegiate rodeo competition. Prior experience is not necessary to be part of the Club. All that is needed is an interest in the sport, meeting people, and having fun.

Club activities focus on the Annual Spartan Stampede Rodeo which the Club organizes and promotes. The Spartan Stampede is one of the most successful intercollegiate rodeos in existence. It has a reputation for quality stock and management that calls cowboys and cowgirls from all parts of the U.S. The MSU Rodeo Club’s Spartan Stampede was chosen by membership of the International Professional Rodeo Association as the “2011 IPRA indoor Rodeo of the Year”.

INTERCOLLEGIATE JUDGING TEAMS
The Department of Animal Science has a rich heritage of successful judging teams. Many former team members who have gone on to obtain leadership roles in the industry as alumni strongly support the judging team experience. Participation on a judging team enhances a student’s ability to think, reason and make decisions, and to communicate with others. These skills are in great demand regardless of the career choice.

Students enrolled in dairy, horse, livestock, meats or welfare judging have the opportunity to travel and visit farms across the US. They can meet and talk to the owners and managers of some of the most successful operations in the world. These contacts help students better understand current management and marketing strategies as well as assist students in making and securing career choices.

Judging is more than visiting farms and taking a class. It is competing against schools all across the U.S. in contests held in conjunction with the major industry events. Some of these are: World Dairy Exposition, Madison, WI; North American Livestock Exposition, Louisville, KY; Quarter Horse Congress, Columbus, OH; and Arabian Nationals, Albuquerque, NM.

Students may earn a maximum of 8 credits from ANS 200A Sec 001, ANS 200A Sec 002, ANS 300A Sec 001, ANS 300A Sec 002, ANS 300B, ANS 300C, ANS 300D, ANS 300E. Many of these courses have a re-enrollment provision so that a student might be able to compete on one or two intercollegiate judging teams.
Judging Teams

DAIRY JUDGING TEAM:  Coach - Dr. Joe Domecq (353-7855)
   ANS 200C  Introductory Judging of Dairy Cattle
          Spring Semester - 1 or 2 credits with a maximum of 3 credits
   ANS 300C  Advanced Dairy Cattle Judging
          Fall Semester - 2 credits

HORSE JUDGING TEAM:  Coach – Dr. Camie Heleski (355-8427)
   ANS 200D  Introductory Judging of Horses
          Spring Semester - 1 or 2 credits with a maximum of 3 credits
   ANS 300D  Advanced Horse Judging
          Fall Semester - 2 credits

LIVESTOCK JUDGING TEAM:  Coach- to be announced
   ANS 200A  Introductory Judging of Livestock or Carcasses
          Spring Semester - 1 or 2 credits with a maximum of 3 credits
   ANS 211  Animal and Product Evaluation
          Fall Semester – 3 credits
   ANS 300A  Advanced Livestock Judging
          Fall Semester - 2 credits

WELFARE JUDGING TEAM:  Coach – Dr. Camie Heleski (355-8427)
   ANS 300E Animal Welfare Judging
          Fall Semester – 1 credit

DAIRY CHALLENGE:  Coach – Dr. Miriam Weber Nielsen (432-5443)
   ANS 200F Dairy Farm Evaluation
          Fall Semester – 1 credit

MEAT JUDGING TEAM  Coach – Sarah Wells (355-8452 ext. 205)
   ANS 200A section 002 Introductory Judging of Meat
          Spring Semester - 1 or 2 credits with a maximum of 3 credits
   ANS 300A section 002 Advanced Judging of Meat
          Fall Semester - 2 credits

AG TECH JUDGING TEAMS
   The contact persons for the Agricultural Technology Judging Teams are:
   Dairy  Dr. Joe Domecq (353-7855)
   Horse  Dr. Camie Heleski (355-8327)

GUIDELINES FOR EXTENDED ABSENCE FROM CLASS

The Department of Animal Science (ANS) recognizes and supports learning outside the classroom and the value of field trips to support curricular and co-curricular activities. However, the value of the experience must be weighed against the academic cost of missing academic work. The primary target audience for these guidelines is students with extended absence from class. The Department of Animal Science does not encourage extended absence from class! Generally it is judging livestock or co-curricular activities associated with exhibiting livestock that cause students to have extended absence from class. Instructors, coaches for judging teams, and barn
managers must follow these guidelines closely.

The guidelines below are intended to inform students about the departmental position on the benefits of co-curricular activities and impact of missing class on academic performance. Students should understand the procedure that their supervisor must follow to enhance the communication with faculty teaching their courses. The concept is to insure that absence from class does not jeopardize academic success of students.

**Definition of Extended Absence and Abbreviated Guidelines:**
An extended period is when a student is absent from class for more than three weekdays. This duration of absence is viewed as a situation that could risk academic welfare and longevity of students.

Any voluntary extended absence from class must be reviewed by the Coordinator of Undergraduate Programs in the Department. This review will establish the academic status of the student before the extended absence. If any student feels they are pressured to miss class they should appeal directly to the Coordinator of ANS Undergraduate Programs. Students who have any questions of concerns about these guidelines should discuss with Dr. John Shelle, Coordinator of ANS Undergraduate Programs at 355-8391 or shelle@msu.edu

**Complete guidelines and policy should be available from coaches, barn managers, or 1250 Anthony Hall.**

**ACADEMIC GOVERNANCE**

ANS undergraduate students have representatives on two standing committees within the Animal Science Department. The ANS Department Advisory Committee consists of five ANS faculty, one staff member, one ANS graduate student, and one ANS undergraduate student. The undergraduate student also serves as the ANS representative to the CANR Student Senate. The ANS Department Advisory Committee meets once per month and serves as a channel of communication with the ANS Department Chairperson.

The ANS Undergraduate Student Affairs and Curriculum Committee consists of four ANS faculty, one ANS graduate student, and two ANS undergraduate students. This committee meets once per month to review and evaluate courses, curricula, and degree requirements for ANS undergraduates.

ANS undergraduates elect their representatives to these committees during spring semester for the following academic year.
Professional internships provide an academic opportunity to work for a period of time in an animal related field while gaining college credit toward graduation requirements. Internship programs have developed into important learning experiences that allow students to develop professional skills, apply classroom information, and establish important contacts for potential careers. Many employers now want students with experience right out of college, making them even more important. Annually, a large number of ANS majors complete an off campus professional internship with the added benefit of securing a maximum of 6 credits counting toward the 120 total graduation requirement. Many students complete the internship after reaching junior or senior class standing. Internship opportunities exist in all areas of animal science, including, livestock production, finance, marketing, and livestock products. Students can choose locations throughout the U.S. or the world.

In order to take full advantage of the professional internship program, a few requirements and guidelines are to be followed to ensure a successful and rewarding experience.

A grade of pass or fail will be assigned based upon satisfactory completion of the following requirements.

1. Interview with Dr. John Shelle.
2. Complete application process.
3. Receive override into ANS 493.
4. Construct a minimum 20 slide Power Point presentation including facilities, responsibilities, and projects.
5. Complete student, employer and program evaluations.
6. Perform exit interview with internship coordinator. For further information, contact Dr. John Shelle, shelle@msu.edu, 1250 Anthony Hall (355-8391) or visit the Animal Science Internship web page at http://www.ans.msu.edu/academics/undergrad/internships.html
Academic Programs in Animal Science (ANS)

ANS Core Courses
(Required for all students)
Page 22

Academic Concentration
(Select One)

- Animal Industry
  Page 23
- Animal Biology or Pre-Veterinary Medicine
  Page 24
- Companion and Exotic Animal Biology
  Page 25
- Production Animal Scholars
  Page 26

Bachelor of Science in Animal Science
# CORE COURSES FOR ALL STUDENTS IN ANIMAL SCIENCE: 2013-2014

## UNIVERSITY REQUIREMENTS

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRA</td>
<td>Writing, Rhetoric &amp; American Culture</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>IAH</td>
<td>Integrative Studies in Arts &amp; Humanities (IAH 201 to 210)</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>IAH</td>
<td>Integrative Studies in Arts &amp; Humanities (IAH 211 or above)</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>ISS</td>
<td>Integrative Studies in Social, Behavior &amp; Economic Sci. (ISS-300)</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 20**

## COLLEGE REQUIREMENTS

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 201 or 202</td>
<td>Economics</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>MTH 116</td>
<td>College Algebra &amp; Trigonometry</td>
<td>F,S,SS</td>
<td>5</td>
</tr>
<tr>
<td>OR</td>
<td>MTH 103 and MTH 114, MTH 103 and STT 200 or STT 201 or MTH 124 or MTH 132</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 8**

## DEPARTMENT REQUIREMENTS (All the courses listed below)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 101</td>
<td>Professional Development in Animal Science I</td>
<td>F,S</td>
<td>1</td>
</tr>
<tr>
<td>ANS 110</td>
<td>Introductory Animal Agriculture</td>
<td>F,S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 313</td>
<td>Principles of Animal Feeding and Nutrition</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>ANS 314</td>
<td>Genetic Improvement of Farm Animals</td>
<td>F,S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 315</td>
<td>Anatomy and Physiology of Farm Animals</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 401</td>
<td>Ethical Issues in Animal Agriculture</td>
<td>S</td>
<td>1</td>
</tr>
<tr>
<td>BS 161</td>
<td>Cells and Molecules</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>BS 171</td>
<td>Cells and Molecular Biology Laboratory</td>
<td>F,S,SS</td>
<td>2</td>
</tr>
<tr>
<td>CEM 141</td>
<td>General Chemistry</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>CEM 143</td>
<td>Survey of Organic Chemistry</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>OR</td>
<td>CEM 251 Organic Chemistry</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 32-33**

## ONE OF THE FOLLOWING COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>STT 200</td>
<td>Statistical Methods</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>STT 201</td>
<td>Statistical Methods</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>STT 421</td>
<td>Statistics I</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>STT 464</td>
<td>Statistics for Biologists</td>
<td>F</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

## ONE OF THE FOLLOWING SPECIES MANAGEMENT COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Semester</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 222</td>
<td>Introductory Beef Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 232</td>
<td>Introductory Dairy Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 242</td>
<td>Introductory Horse Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 252</td>
<td>Introductory to Management of Avian Species</td>
<td>F, odd yr.</td>
<td>3</td>
</tr>
<tr>
<td>ANS 262</td>
<td>Introductory Sheep Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 272</td>
<td>Introductory Swine Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 282</td>
<td>Companion Animal Biology &amp; Management</td>
<td>F,S</td>
<td>3</td>
</tr>
</tbody>
</table>

For Production Animal Scholars ANS 242 and 282 are excluded

**TOTAL CREDITS 3**

## ONE OF THE FOLLOWING CONCENTRATIONS:

- Animal Industry: 25-34
- Animal Biology and Pre-Veterinary Medicine: 39-54
- Companion and Exotic Animal Biology: 41-51
- Production Animal Scholars: 52-55

**ELECTIVES**

**TOTAL CREDITS 120**

Please Note: Students must complete the above requirements along with one of the following concentrations on the following pages.
## ANIMAL INDUSTRY CONCENTRATION

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 201</td>
<td>Animal Products</td>
<td>F</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

**ONE OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 110</td>
<td>Computer Applications in Agronomy</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>CSE 101</td>
<td>Introduction to Computing</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

**ONE OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABM 100</td>
<td>Decision-making in the Agri-Food System</td>
<td>F, S</td>
<td>3</td>
</tr>
<tr>
<td>ABM 130</td>
<td>Farm Management I</td>
<td>F</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

**ONE OF THE FOLLOWING COURSES** in addition to the required species management course from ANS Core for a total of two courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 222</td>
<td>Introductory Beef Cattle Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 232</td>
<td>Introductory Dairy Cattle Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 242</td>
<td>Introductory Horse Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 252</td>
<td>Introduction to Management of Avian Species</td>
<td>F odd yr.</td>
<td>3</td>
</tr>
<tr>
<td>ANS 262</td>
<td>Introductory Sheep Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 272</td>
<td>Introductory Swine Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 282</td>
<td>Introductory Companion Animal Biology &amp; Mgmt</td>
<td>F, S</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

**ONE OF THE FOLLOWING COURSES**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 422</td>
<td>Advanced Feedlot Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 432</td>
<td>Advanced Dairy Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 442</td>
<td>Advanced Horse Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 472</td>
<td>Advanced Swine Management</td>
<td>S even yr.</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

**SIX CREDITS OF THE FOLLOWING COURSES**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 211</td>
<td>Animal and Product Evaluation</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 305</td>
<td>Applied Animal Behavior</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 309</td>
<td>Animal Health Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 405</td>
<td>Endocrinology of Reproduction</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>ANS 407</td>
<td>Food and Animal Toxicology</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 413</td>
<td>Non-Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 418</td>
<td>Comprehensive Nutrient Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 435</td>
<td>Mammary Physiology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 445</td>
<td>Equine Exercise Physiology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 455</td>
<td>Avian Physiology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 483</td>
<td>Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 6-12**

**ONE OF THE FOLLOWING COURSES**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 493</td>
<td>Professional Internship</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>ANS 300A,B,C, D or E</td>
<td>Judging</td>
<td>F</td>
<td>6</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3-6**

*Please note: ANS Majors Must Also Complete Requirements on Page 23 along with their selected concentration.*
**ANIMAL BIOLOGY OR PRE-VETERINARY MEDICINE CONCENTRATION**

**ALL OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Semester(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 201</td>
<td>Animal Products</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 425</td>
<td>Principles of Biotechnology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>BMB 401</td>
<td>Biochemistry</td>
<td>F, S, SS</td>
<td>4</td>
</tr>
<tr>
<td>CEM 161</td>
<td>Chemistry Laboratory I</td>
<td>F, S, SS</td>
<td>1</td>
</tr>
<tr>
<td>CEM 252</td>
<td>Organic Chemistry II</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>CEM 255</td>
<td>Organic Chemistry Lab</td>
<td>F, S, SS</td>
<td>2</td>
</tr>
<tr>
<td>BS 162</td>
<td>Organisms and Populations</td>
<td>F, S, SS</td>
<td>4</td>
</tr>
<tr>
<td>BS 172</td>
<td>Organisms and Populations laboratory</td>
<td>F, S, SS</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 23**

**SEVEN CREDITS OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Semester(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 405</td>
<td>Endocrinology of Reproduction</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>ANS 413</td>
<td>Non-Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 435</td>
<td>Mammary Physiology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 483</td>
<td>Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 7-11**

**EIGHT CREDITS OF THE FOLLOWING COURSES:** (*required for admission to MSU Veterinary Medicine*)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Semester(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 305</td>
<td>Applied Animal Behavior</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 309</td>
<td>Animal Health Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 407</td>
<td>Food and Animal Toxicology</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 418</td>
<td>Comprehensive Nutrient Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 445</td>
<td>Equine Exercise Physiology</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>ANS 455</td>
<td>Avian Physiology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>*MMG 301</td>
<td>Introductory Microbiology</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>*MMG 302</td>
<td>Introductory Microbiology Laboratory</td>
<td>S, SS</td>
<td>1</td>
</tr>
<tr>
<td>*MMG 409</td>
<td>Eucaryotic Cell Biology</td>
<td>S, SS</td>
<td>3</td>
</tr>
<tr>
<td>PHM 450</td>
<td>Introduction to Chemical Toxicology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>*PHY 231</td>
<td>Introductory Physics I</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>*PHY 232</td>
<td>Introductory Physics II</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>*PHY 251</td>
<td>Introductory Physics Laboratory I</td>
<td>F, S, SS</td>
<td>1</td>
</tr>
<tr>
<td>*PHY 252</td>
<td>Introductory Physics Laboratory II</td>
<td>F, S, SS</td>
<td>1</td>
</tr>
<tr>
<td>ZOL 313</td>
<td>Animal Behavior</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>ZOL 341</td>
<td>Fundamental Genetics (Can replace ANS 314)</td>
<td>S, SS</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 8-15**

**ONE OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Semester(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 492</td>
<td>Undergraduate Research</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>ANS 493</td>
<td>Professional Internship in ANS</td>
<td>F, S, SS</td>
<td>3</td>
</tr>
<tr>
<td>Study Abroad</td>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3-6**

Please note: ANS Majors Must Also Complete Requirements on Page 23 along with their selected concentration.

*Pre-Veterinary Science requirement.*
COMPANION AND EXOTIC ANIMAL BIOLOGY CONCENTRATION

ALL OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 282</td>
<td>Companion Animal Biology and Management</td>
<td>F,S</td>
<td>3</td>
</tr>
<tr>
<td>BS 162</td>
<td>Organisms and Populations</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>BS 172</td>
<td>Organisms and Populations Laboratory</td>
<td>F,S,SS</td>
<td>2</td>
</tr>
<tr>
<td>CEM 252</td>
<td>Organic Chemistry II</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>CEM 255</td>
<td>Organic Chemistry Lab</td>
<td>F,S,SS</td>
<td>2</td>
</tr>
<tr>
<td>ZOL 328</td>
<td>Comparative Anatomy and Biology of Vertebrates</td>
<td>S</td>
<td>4</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 18

ONE OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB 200</td>
<td>Introduction to Biochemistry</td>
<td>F,SS</td>
<td>4</td>
</tr>
<tr>
<td>BMB 401</td>
<td>Basic Biochemistry</td>
<td>F,SS</td>
<td>4</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 4

SIX CREDITS OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 305</td>
<td>Applied Animal Behavior</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 405</td>
<td>Endocrinology of Reproduction</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>ANS 413</td>
<td>Non-Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 435</td>
<td>Mammary Physiology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>ANS 483</td>
<td>Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 6-8

ELEVEN CREDITS OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 407</td>
<td>Food and Animal Toxicology</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 418</td>
<td>Comprehensive Nutrient Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 425</td>
<td>Principles of Animal Biotechnology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 445</td>
<td>Equine Exercise Physiology</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>ANS 455</td>
<td>Avian Physiology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>ZOL 313</td>
<td>Animal Behavior</td>
<td>F,SS</td>
<td>3</td>
</tr>
<tr>
<td>ZOL 341</td>
<td>Fundamental Genetics (Can replace ANS 314)</td>
<td>F,SS</td>
<td>4</td>
</tr>
<tr>
<td>ZOL 355</td>
<td>Ecology</td>
<td>F,SS</td>
<td>3</td>
</tr>
<tr>
<td>ZOL 369</td>
<td>Introduction to Zoo and Aquarium Science</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 11-16

ONE OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 492</td>
<td>Undergraduate Research</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>ANS 493</td>
<td>Professional Internship in ANS</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>Study Abroad</td>
<td></td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL CREDITS 3-6

Please note: ANS Majors Must Also Complete Requirements on Page 23 along with their selected concentration.
# PRODUCTION ANIMAL SCHOLARS CONCENTRATION

**ALL OF THE FOLLOWING COURSES:** (*required for admission to MSU Veterinary Medicine)*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 201</td>
<td>Animal Products</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>BS 162</td>
<td>Organisms and Populations</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>BS 172</td>
<td>Organisms and Populations Laboratory</td>
<td>F,S,SS</td>
<td>2</td>
</tr>
<tr>
<td>BMB 401</td>
<td>Biochemistry</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>CEM 161</td>
<td>Chemistry Laboratory I</td>
<td>F,S,SS</td>
<td>1</td>
</tr>
<tr>
<td>CEM 252</td>
<td>Organic Chemistry II</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>CEM 255</td>
<td>Organic Chemistry Lab</td>
<td>F,S,SS</td>
<td>2</td>
</tr>
<tr>
<td>*MMG 301</td>
<td>Introductory Microbiology</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>*MMG 302</td>
<td>Introductory Microbiology Laboratory</td>
<td>S,SS</td>
<td>1</td>
</tr>
<tr>
<td>*MMG 409</td>
<td>Eucaryotic Cell Biology</td>
<td>S,SS</td>
<td>3</td>
</tr>
<tr>
<td>*PHY 231</td>
<td>Introductory Physics I</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>*PHY 232</td>
<td>Introductory Physics II</td>
<td>F,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>*PHY 251</td>
<td>Introductory Physics Laboratory I</td>
<td>F,S,SS</td>
<td>1</td>
</tr>
<tr>
<td>*PHY 252</td>
<td>Introductory Physics Laboratory II</td>
<td>F,S,SS</td>
<td>1</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 34**

**ONE OF THE FOLLOWING COURSES** in addition to the required species management course from ANS Core for a total of two courses. ANS 242 and 282 are excluded.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 222</td>
<td>Introductory Beef Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 232</td>
<td>Introductory Dairy Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 252</td>
<td>Introduction to Management of Avian Species</td>
<td>F odd yr.</td>
<td>3</td>
</tr>
<tr>
<td>ANS 262</td>
<td>Introductory Sheep Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 272</td>
<td>Introductory Swine Management</td>
<td>F</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

**TWO OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABM 435</td>
<td>Financial Management in the Agri-Food System</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ABM 437</td>
<td>Agribusiness Strategic Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 413</td>
<td>Non-Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 483</td>
<td>Ruminant Nutrition</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 6**

**SIX CREDITS OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 305</td>
<td>Applied Animal Behavior</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 309</td>
<td>Animal Health Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 405</td>
<td>Endocrinology of Reproduction</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>ANS 425</td>
<td>Principles of Animal Biotechnology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 435</td>
<td>Mammary Physiology</td>
<td>S</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3-4**

**ONE OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 422</td>
<td>Advanced Beef Feedlot Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 432</td>
<td>Advanced Dairy Cattle Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 472</td>
<td>Advanced Swine Management</td>
<td>S even yr</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3**

**THREE CREDITS OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 407</td>
<td>Food and Animal Toxicology</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 418</td>
<td>Comprehensive Nutrient Management</td>
<td>F</td>
<td>3</td>
</tr>
</tbody>
</table>

Production Animal Scholars continues on the next page

*Pre-Veterinary science requirement.*
Coordinate Academic Opportunities

Lyman Briggs College at Michigan State University
Students who desire to enter a health profession or a career in basic science may pursue a coordinate program between Lyman Briggs College and Animal Science. Note that Lyman Briggs is the actual college with a major in ANS. Also, for pre-veterinary students this is simply a different path with no competitive advantage for acceptance into veterinary college.

Mid-West Poultry Consortium
Students who are especially interested in poultry should consider the Mid-West Poultry Consortium. This program is offered in Madison, WI during the summer. Over two summers, students may complete a maximum of six courses and all credits transfer to MSU. Some courses may be used to fulfill requirements in Animal Science at MSU. Poultry experts from across the United States teach the courses. Internship opportunities are highly likely. This program has limited enrollment, is competitive to enter, but is supported with generous scholarships for tuition. Students who do not receive a scholarship from Mid-West Poultry Consortium may enroll in classes and attend when they pay in-state tuition on their own.
CANR Specializations
While completing the requirement for a degree in Animal Science, the student has the opportunity to use their elective credits to complete one of the Specializations available in the College of Agriculture and Natural Resources. The following are two Specializations that are excellent choices to accompany a degree in Animal Science.

Agriculture and Natural Resources Biotechnology Specialization
The Specialization in Agricultural and Natural Resources Biotechnology is available as an elective to students who are enrolled in Bachelor of Science degree programs with majors in animal science, biosystems engineering, crop and soil sciences, fisheries and wildlife, food science, forestry, and horticulture. The specialization is administered by the College of Agriculture and Natural Resources.

The specialization is designed for students who may be planning to pursue graduate study in biotechnology–related disciplines or who may be interested in careers with corporations or agencies for which a basic familiarity with biotechnology is a prerequisite. Students interested in the Agriculture and Natural Resources Biotechnology Specialization should contact Dr. Richard Brandenburg at 355-0236 or 120 Ag Hall for information on how to enroll for the specialization.

ALL OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB 401</td>
<td>Basic Biochemistry</td>
<td>F, S, SS</td>
<td>4</td>
</tr>
<tr>
<td>HRT 486</td>
<td>Biotechnology in Agriculture</td>
<td>F</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3-4**

ONE OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 314</td>
<td>Genetic Improvement of Domestic Animals</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>CSS 350</td>
<td>Introduction to Plant Genetics</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ZOL 341</td>
<td>Fundamental Genetics</td>
<td>F, S, SS</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 3-4**

COMPLETE ONE OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 425</td>
<td>Principles of Animal Biotechnology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>CSS 451</td>
<td>Biotech. Appl. For Plant Breeding and Genetics</td>
<td>S</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 4-5**

Please note: ANS Majors Must Also Complete Requirements on Page 23 along with their selected concentration.
SPECIALIZATION IN AGribusiness Management

The Agribusiness Management specialization, offered by the Department of Agricultural, Food, and Resource Economics, combines broad training in business with specialized training in the unique problems of managing agribusiness firms. This specialization provides a foundation level of skills for students who are interested in careers in agribusiness but whose primary interest is in another field. The specialization broadens students’ educational opportunities and enhances their attractiveness to agribusiness employers. Total credits for specialization = 18

<table>
<thead>
<tr>
<th>REQUIREMENTS</th>
<th>Cr.</th>
<th>PREREQUISITES</th>
<th>F</th>
<th>Sp</th>
<th>Su</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of the following:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACC 201 Principles of Financial Accounting</td>
<td>3</td>
<td>None; not open to freshmen</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ACC 230 Survey of Accounting Concepts</td>
<td>3</td>
<td>None; not open to freshmen</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>One of the following:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 100 Decision-Making in Agri-Food System</td>
<td>3</td>
<td>None</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>ABM 130 Farm Management I</td>
<td>3</td>
<td>None</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One of the following:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 225 Commodity Marketing I</td>
<td>3</td>
<td>ABM 100 or EC 201</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 430 Farm Management II</td>
<td>3</td>
<td>ABM 130; Jr or Sr status</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 435* Financial Management in the Agri-Food System</td>
<td>3</td>
<td>(ACC 230 or 201) and (ABM 130 or 100 or EC 201 or 202 ) recommended but not required; Jr or Sr status required</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two of the following, including at least one at the 300 or 400 level:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: Food Industry Mgt. majors must choose one course that does NOT also fulfill any FIM degree requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 222 Agribusiness &amp; Food Industry Sales</td>
<td>3</td>
<td>ABM 100 or ABM 130 or EC 201 or EC202; completion of Tier I (WRA) writing course; Soph, Jr, or Sr status</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ABM 337 Labor and Personnel Mgt. in the Agri-Food System</td>
<td>3</td>
<td>ABM 100 or ABM 130 or HRT 404; Jr or Sr status</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>ABM 400 Public Policy Issues in the Agri-Food System</td>
<td>3</td>
<td>ABM 100, Jr or Sr status</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>ABM 422 Vertical Coordination in the Agri-Food System</td>
<td>3</td>
<td>ABM 100 and EC 201; Jr or Sr status</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>ABM 425 Commodity Marketing II</td>
<td>3</td>
<td>ABM 225 and (STT 200 or 201 or 315 or ANS 314 or CSS 350 or concurrently)</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 427 Global Agri-Food Industries &amp; Markets</td>
<td>3</td>
<td>FIM 220 or ABM 225</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 435* Financial Management in the Agri-Food System</td>
<td>3</td>
<td>Recommended: (ACC 201 or 230) and (ABM 100 or 130 or EC 201 or 202); Jr or Sr status required</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABM 437** Agribusiness Strategic Management OR **Non-ABM majors should see an ABM Advisor to plan for prerequisites for this course</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIM 439*** Food Business Analysis and Strategic Planning</td>
<td>3</td>
<td>FIM 220, ABM 435, and ABM 430; completion of Tier I (WRA) writing requirement; Sr status</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>ABM 100, ABM 130, ABM 225, and ABM 430 may be used here if not used to fulfill requirements above</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>One of the following:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>GBL 323 Introduction to Business Law</td>
<td>3</td>
<td>Jr or Sr status</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MGT 325 Management Skills &amp; Processes</td>
<td>3</td>
<td>Jr or Sr status</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MKT 327 Introduction to Marketing</td>
<td>3</td>
<td>Jr or Sr status</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

ABM 435 can be used once in either the “chose one” or “chose two” category. To apply for the ABM Specialization, contact Ruthi Bloomfield, 432-5298, Room 1, Agriculture Hall. ANS Majors must complete requirements on Page 23 along with their selected concentration.
101 Professional Development Animal Science I. Fall and Spring 1(0-2)
Careers in animal science. Job application, portfolio development, interviewing, and resume development.

110 Introductory Animal Agriculture. Fall and Spring 4(3-2)

140 Fundamentals of Horsemanship. Fall and Spring 2(0-4)
Knowledge and implementation of safe horse handling skills. Development and improvement of riding skills. Application of riding aids and working with the horse at the beginner, intermediate or advance level.

141 Draft Horse Basics. Fall 2(0-4)
Safe handling, hitching and driving of draft horses. Care and maintenance of harness and horse drawn equipment.

142 Horse Training for Competition. Summer 2(0-4)
Implementation of training techniques to prepare horses for State competitions. Exhibiting horses in competitions. Field trips required.

200A (Section 01) Introductory Judging Livestock or Carcasses. Spring (1-2 credits)

200A (Section 02) Introductory Judging Meat. Fall (1-2 credits)
Evaluation of beef, sheep, and pork. Preparation for intercollegiate competition. Field trips required.

200C Introductory Judging of Dairy Cattle. Spring (1-2 credits)

200D Introductory Judging of Horses. Spring (1-2 credits)

200E Introductory Animal Welfare Assessment. Spring 1 (0-2 credits)
Physiological and behavioral indicators of animal welfare. Quantitative measures and ethical issues. Written and oral assessments of animal welfare.

200F Dairy Farm Evaluation.

201 Animal Products. Fall 3(3-3)
Edible animal products. Processing, preservation, storage, and distribution of dairy, meat, and egg products.
201L  Animal Products laboratory. Fall 1(0-3)
Processing and evaluation of meat, milk and egg products.

211 Animal and Product Evaluation. Fall 3(0-4)
Evaluation of breeding stock, market animals and carcasses. Performance records and structural correctness of breeding animals. Quality grading, yield grading and pricing of market animals and carcasses.

212 Merchandising Purebred Livestock. Spring (odd-numbered years) 2(1-2)
Purebred livestock industry. Private treaty and auction sales. Advertising, animal selection, and budgeting of purebred livestock sales. Field trips required.

222 Introductory Beef Management. Spring 2(2-0)
Management practices and systems for beef herds. Feed requirements, reproduction, breeding, performance testing, housing, and diseases. Costs and returns. Field trips required.

225 Horse Behavior and Welfare. Summer 2(2-0)
Natural behavior, senses, training, psychology, and common behavioral problems in horses. Equine welfare issues.

232 Introductory Dairy Management. Fall 3(2-2)
Principles and techniques of dairy herd management including calf and heifer care plus lactating and dry cow management.

242 Introductory Horse Management. Fall 3(2-2)
Principles of horse management. Reproduction, nutrition, herd health, genetics, economics, marketing. Field trips required.

252 Introduction to Management of Avian Species. Fall(odd-numbered years) 3(2-2)
Management of commercial poultry flocks and aviaries. Feed requirements, reproduction, breeding, housing and disease.

261 Principles of Animal Environments. Spring 2(1-2)

262 Introductory Sheep Management. Spring 3(2-2)
Principles of sheep management: genetics, reproduction, nutrition, marketing, and economics. Field trips required.

272 Introductory Swine Management. Fall 3(2-2)
Swine production principles, practices, technologies, and systems. Field trips required.

282 Companion Animal Biology and Management. Fall and Spring 3(2-2)
Principles of companion animal management. Breeds, reproduction, feeding, housing, health, and diseases.

300A (Section 01) Advanced Livestock Judging. Fall 2(0-6)
Evaluation of conformation and performance records of beef cattle, swine, and sheep. Represent MSU in intercollegiate competition. Field trips required.
300A (Section 02) Advanced Meat Judging. Spring 2(0-6)
Evaluation of beef, pork, and sheep. Represent MSU in intercollegiate competition. Field trips required.

300C Advanced Dairy Cattle Judging. Fall 2(0-6)
Evaluation of conformation of various breeds of dairy cattle. Represent MSU in intercollegiate competition. Field trips required.

300D Advanced Horse Judging. Fall 2(0-6)
Evaluation of functional characteristics of horses. Represent MSU in intercollegiate competition. Field trips required.

300E Animal Welfare Judging. Fall 1(0-2)
Enhanced understanding of the physiological and behavioral indicators of animal welfare. Ethical values in the assessment of welfare status. Intercollegiate competition. Field trip required.

305 Applied Animal Behavior. Spring 3(2-2)
Techniques for assessing health and welfare of domestic animals based on their behavior.

309 Animal Health Management. Fall 3(3-0)

313 Principles of Animal Feeding and Nutrition. Fall 4(3-2)

314 Genetic Improvement of Farm Animals. Fall and Spring 4(3-2)
Molecular, Mendelian, population, and quantitative genetics of domestic animals.

315 Anatomy and Physiology of Farm Animals. Spring 4(3-2)

401 Ethical Issues in Animal Agriculture. Spring 1(2-0)
Societal issues related to local, national and international animal agriculture.

405 Endocrinology of Reproduction. Fall 4(3-2)
Endocrine regulation of reproduction. Cellular and molecular aspects of gametogenesis, folliculogenesis, sexual cycles, fertilization, sex differentiation, gestation, and parturition. Technology to regulate reproduction.

407 Food and Animal Toxicology. Fall 3(3-0)
Fate and effects of chemicals in the food chain including impact on animal production. Residues in food products. Food safety assessment. Control methods.

413 Non-Ruminant Nutrition. Spring 3(3-0)
Nutrition of horses, swine, and poultry. Digestive and metabolic development and nutrient requirements. Relationships of genetics, endocrinology, immunology, and environment to nutrition.
418 Comprehensive Nutrient Management Planning. Fall 3(2-2)
Comprehensive nutrient management plans (CNMP) for animal feeding operations. Trends in animal production, environmental issues, and diet formulation and their impact on manure production. Development of CNMP for a specific animal feeding operation.

422 Advanced Beef Cattle Feedlot Management. Fall 3(2-2)
Feedlot management systems and issues. Feed systems, manure management, health maintenance, and cattle marketing. Field trips required.

425 Principles of Animal Biotechnology. Spring 3(3-0)
Basic concepts of molecular biology. Application of molecular biology to improvement of domestic and companion animals is emphasized. Transgenic animal production, Pharming, molecular genetics and Marker assisted selection.

427 Environmental Toxicology and Society. Spring 3(3-0)
Impact of environmental chemicals on health and modern society. Cellular and organ functions and their interface with the environment. Limitations of scientific investigation and environmental regulations.

432 Advanced Dairy Cattle Management. Fall 3(2-2)
Management techniques for operating a dairy herd. Mastitis control, reproductive and nutritional management, records, waste management, and facilities. Field trips required.

435 Mammary Physiology. Spring 4(3-2)

442 Advanced Horse Management. Spring 3(2-2)
Management of stables and breeding farms. Pedigree and conformational selection, reproduction, promotion, marketing, and economics. Nutrition and feeding, facilities, and herd health. Field trips required.

445 Equine Exercise Physiology. Fall 4(3-2)
Research in equine exercise science. Physical, physiologic, metabolic and mental adaptation to athletic training. Nutrition and bioenergetics of muscle metabolism. Field trip required.

455 Avian Physiology. Spring 4(3-3)
Systemic and comparative physiology of birds. Respiration, reproduction, endocrinology, digestion, urination, and the senses.

464 Statistical Methods for Biologists I. Fall 3(3-0)
Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression (prediction). Analyses of counted and measured data to compare several biological groups (contingency tables and analysis of variance).

472 Advanced Swine Management. Spring even years 3(2-2)
Integrated management practices of swine enterprises. Facilities and environmental needs, genetics, nutrition, reproduction, and disease control. Economics and marketing. Field trips required.

480 Animal Systems in International Development. Spring 3(3-0)
Animal Systems in various global regions. Output, land and resource conservation, and socioeconomic factors.
483  Ruminant Nutrition. Spring 3(3-0)
Physiology and metabolism in ruminants. Prehension, digestion, metabolism, absorption, and
distribution of nutrients for productive functions. Feeding management strategies and diet
formulation. Field trip may be required.

490  Independent study. Fall, Spring, and Summer (1-4 credits)
Independent study in genetics, nutrition, physiology, toxicology, meat science, or management of
poultry, livestock, and horses.

492  Undergraduate Research in Animal Science. Fall, Spring, and Summer 3(0-6)
Faculty supervised research in selected areas of animal science.

493  Professional Internship in Animal Science. Fall, Spring, and Summer  3 cr.
Supervised professional experience in the animal industry.

499  Senior Thesis in Animal Science. Fall, Spring, and Summer (3-9 credits)
Individual studies in an area of choice with both oral and written final communications. Topic to be
determined by student and guidance committee.
AGRICULTURAL TECHNOLOGY PROGRAMS

The Department of Animal Science and the Institute of Agricultural Technology offer students a career choice in vocational education. Program areas coordinated in ANS include dairy, beef, swine, and horse management. These programs are designed to meet the needs of students who choose to make production agriculture a career and are interested in on farm application of knowledge. Courses are animal oriented and are taught with a "hands on" philosophy in most of the instruction. Agricultural Technology programs are 12 to 18 months in length. They involve 2-3 semesters on campus taking courses in the program area. With 2 to 3 semesters of course work, students are encouraged/required to participate in placement training, on cooperating farms. These internships allow Ag Tech students to gain the experience they need on a working farm. Students may enroll for up to 6 credits and 6 months of placement training under the supervision of faculty from ANS.

Students enrolled in Animal Science Ag Tech programs receive all services available to students at the University, including intramural and university sports, financial aid, housing, and are encouraged to participate in student clubs within the department and college.
Because dairy farming is the leading agricultural enterprise in Michigan, the dairy program has been developed to meet the specialized needs of the herd manager and commercial diary farm. Opportunities abound for persons with the combination of classroom training in the areas of dairy husbandry, nutrition, artificial insemination, crops, farm management, and the practical experience that can be obtained on any of the many cooperating dairy farms in Michigan and neighboring states.

Programs of study tailored to meet the individuals’ wants and needs are designed around the subject matter areas of agricultural economics, communications, crop and soil sciences, and agricultural mechanics. All students must complete an internship, which can be completed on dairy operations across the country.

Suggested Curriculum

**Fall of First Year**
- Decision Making in the Agri-Food System ........................................... ABM 100 3 cr.
- Farm Management I ........................................................................... ABM 130 3 cr.
- Dairy Farm Management Seminar .................................................. ANS 132 1 cr.
- Introduction to Dairy Production ...................................................... ANS 232 3 cr.
- Technical Math .............................................................................. AT 071 2 cr.
- Agriculture Communications ........................................................... AT 045 2 cr.
- Microcomputers .............................................................................. CSS 110 2 cr.

**Total Credits** .................................................................................................................... 16 cr.

**Spring of First Year**
- Dairy Herd Reproduction ................................................................. ANS 235 2 cr.
- Principles of Livestock Feeding ....................................................... ANS 203 2 cr.
- Livestock Structure and Function .................................................... ANS 295 2 cr.
- Dairy Health Management .............................................................. ANS 238 3 cr.
- Spanish for Agriculture .................................................................... AT 291 2 cr.
- Professional Internship in Ag Technology ....................................... AT 293 3 cr.

**Total Credits** .................................................................................................................... 14 cr.

**Fall of Second Year**
- Commodity Marketing I ................................................................... ABM 225 3 cr.
- Dairy Herd Management ................................................................. ANS 230 3 cr.
- Dairy Feed Management ................................................................... ANS 233 3 cr.
- Growth, Health and Lactation in Dairy Cattle ................................... ANS 215 2 cr.
- Forage Crops .................................................................................. CSS 201 3 cr.

**Total Credits** .................................................................................................................... 14cr.

**Electives** ........................................................................................................................... 4 cr.

**Program Total** .................................................................................................................... 48 cr.
Description of Dairy Related Coursework
INSTITUTE OF AGRICULTURAL TECHNOLOGY

ANS 132 Dairy Farm Management Seminar
Challenges and opportunities in the dairy industry.

ANS 200C Introduction to Dairy Cattle Judging
Evaluation of functional conformation of dairy cattle. Preparation for intercollegiate competition. Field Trips required. Requires instructor approval only.

ANS 203 Principles of Livestock Feeding
Feed nutrients, digestion and metabolism. Classification of feeds. Nutrient requirements for dairy and beef cattle, sheep, swine and horses.

ANS 215 Growth, Health, and Lactation in Dairy Cattle

ANS 230 Dairy Herd Management

ANS 232 Introductory Dairy Cattle Management
Principles and techniques of dairy herd management including calf and heifer care plus lactating and dry cow management.

ANS 233 Dairy Feed Management

ANS 235 Dairy Herd Reproduction
Application of reproductive principles to dairy production.

ANS 238 Dairy Health Management
Detection of dairy cattle disease. Infections and metabolic problems.

ANS 295 Structure and Function of Livestock
Gross anatomy of livestock. Functions of tissues and organs. Regulation of growth, lactation, reproduction, seasonality, and temperature.
BEEF MANAGEMENT
INSTITUTE OF AGRICULTURAL TECHNOLOGY

This major is designed to allow students the opportunity to specialize in beef. The program also provides the flexibility to combine two or more of the previously mentioned areas to develop individualized programs of study. Many livestock program graduates return to the home farm. However, many requests are received for potential employees who are capable, industrious, and have the practical experience and specialized training provided through this program. These requests are for positions of responsibility as herd managers, assistant herd managers, and in other livestock-related areas.

In this rapidly changing era, agriculture requires aggressive young people who have specialized training in modern scientific farming. The demands for success are limited only by desire and imagination.

Suggested Curriculum

Fall Semester
- Farm Management I ................................................................. ABM 130 3 cr.
- Animal and Product Evaluation ............................................. ANS 211 3 cr.
- Feedlot Clerkship ...................................................................... ANS 122A  2 cr.
- Computer Applications ............................................................. CSS 110  2 cr.
- General Education1 .................................................................... 4 cr.
- Electives ....................................................................................... 3 cr.
Total Credits ................................................................................................. 17 cr.

Spring Semester
- Cow/Calf Clerkship ...................................................................... ANS 122B  2 cr.
- Principles of Livestock Feeding .................................................. ANS 203  2 cr.
- Livestock Structure and Function .............................................. ANS 295  2 cr.
- Introductory Animal Agriculture ............................................... ANS 110  4 cr.
- Introduction Beef Cattle Management ........................................ ANS 222  3 cr.
- Professional Internship in Ag Technology* ............................... AT  293  6 cr.
Total Credits ................................................................................................. 19 cr.

Program Total ................................................................................................. 35 cr.

General Education
- Agricultural Communications (FS) ............................................. AT  045  2 cr.
- Technical Mathematics (FS) ...................................................... AT  071  2 cr.

Suggested Electives
- Decision Making in the Agri-Food System (FS) ......................... ABM 100  3 cr.
- Introductory Judging of Livestock and Carcasses (SS) .................. ANS 200A  1-3 cr.
- Merchandising Purebred Livestock (SS-Even Years) .................. ANS 212  2 cr.
- Introductory Horse Management (FS) ........................................ ANS 242  3 cr.
- Principles of Animal Environments (SS) ..................................... ANS 261  2 cr.
- Introductory Sheep Management (SS) ........................................ ANS 262  3 cr.
- Introductory Swine Management (FS) ........................................ ANS 272  3 cr.
- Agricultural Finance (SS) ......................................................... AT  055  2 cr.
- Introduction to Crop Science (FS) .............................................. CSS 101  3 cr.
- Forage Crops (FS) ................................................................. CSS 201  3 cr.
Description of Beef Related Coursework
INSTITUTE OF AGRICULTURAL TECHNOLOGY

ANS 110 Introductory Animal Agriculture
History of animal agriculture and its relationship to human needs, production systems, marketing, and environmental considerations. Current goals of and limitations affecting U.S. farm animal production.

ANS 122A Feedlot Clerkship
Clerkship to gain hands-on skills in the management of a working feedlot. Feeding cattle, feed storage, manure management, health programs, evaluation and selection of cattle, facilities maintenance, marketing fed cattle.

ANS 122B Beef Cow Calf Clerkship
Clerkship to gain hands-on skills in the management of a working cow-calf farm. Feeding, reproduction, genetics, and selection, facilities maintenance, exhibiting cattle for sale and daily management skills.

ANS 203 Principles of Livestock Feeding
Feed nutrients, digestion and metabolism. Classification of feeds. Nutrient requirements for dairy and beef cattle, sheep, swine and horses.

ANS 211 Animal and Product Evaluation
Evaluation of breeding stock, market animals and carcasses. Production records and soundness of breeding animals. Quality grading, yield grading and pricing of market animals and carcasses.

ANS 222 Introductory Beef Cattle Management
Management practices and systems for beef herds. Feed requirements, reproduction, breeding, performance testing, housing, and diseases. Costs and returns.

ANS 295 Livestock Structure and Function
Gross anatomy of livestock. Functions of tissues and organs. Regulation of growth, lactation, reproduction, seasonality, and temperature.
HORSE MANAGEMENT
INSTITUTE OF AGRICULTURAL TECHNOLOGY

Horse Management emphasizes management and equine skills that will prepare students for positions in the U.S. growing horse industry. There are many opportunities for students in the saddle, pleasure, and racehorse industry, if they have the proper training in management and production techniques. This program offers the most current training available in these areas.

Students spend one semester on placement training working with professionals in the horse industry. Leaders within the horse industry have been very supportive and are ready and willing to work closely with students.

**Suggested Curriculum**

### Fall of First Year
- Horse Behavior & Welfare ......................................................... ANS 145  1 cr.
- Fundamentals of Horsemanship ................................................. ANS 140  2 cr.
- Introductory Horse Management .............................................. ANS 242  3 cr.
- Farm Management I ................................................................. ABM 130  3 cr.
- Technical Math ......................................................................... AT 071  2 cr.
- Agriculture Communications ................................................... AT 045  2 cr.
- Microcomputers ........................................................................ CSS 110  2 cr.

**Total Credits** ........................................................................ 15 cr.

### Spring of First Year
- Introductory Judging Horses .................................................... ANS 200D  2 cr.
- Fundamentals of Horse Training or Horsemanship II Section 002  ANS 146  2 cr.
- Horse Management Placement Seminar .................................. ANS 147  1 cr.
- Horse Management Clerkship at MSU Farm ................................. ANS 149  2 cr.
- Principles of Livestock Feeding .................................................. ANS 203  2 cr.
- Livestock Structure and Function .............................................. ANS 295  2 cr.
- Electives ................................................................................... 2-3 cr.

**Total Credits** ........................................................................ 13-14 cr.

### Summer of First Year or Spring of Second Year
- Placement Training/Internship .................................................. AT 293  6 cr.

### Fall of Second Year
- Horse Farm Management ....................................................... ANS 240  3 cr.
- Horse Nutrition & Feeding ....................................................... ANS 243  2 cr.
- Horse Exercise Physiology ....................................................... ANS 245  2 cr.
- Horse Selection & Judging II (other options) ............................. ANS 300D  1-2 cr.
- Agribusiness & Food Industry Sales (other options) ............... ABM 222  3 cr.
- Forage Crops (other options) .................................................. CSS 201  3 cr.

**Total Credits** ........................................................................ 13-14 cr.

**Program Total** ...................................................................... 48 cr.
Description of Horse Related Coursework
INSTITUTE OF AGRICULTURAL TECHNOLOGY

ANS 140 Fundamentals of Horsemanship
Safe horse handling skills. Riding skills. Riding aids and working with the horse at the beginner, intermediate or advanced level.

ANS 140 Horsemanship II (section 002)
Continuation of principles learned in ANS 140. Admittance by instructor approval only.

ANS 142 Horse Training for Competition (Summer)
Training techniques to prepare horses for competition. Exhibiting horses. Requires instructor approval.

ANS 145 Horse Behavior

ANS 146 Fundamentals of Horse Training
Training and preparing an untrained horse for showing. Sale preparation. Admittance by instructor approval.

ANS 147 Horse Management Placement Seminar
Securing a placement training experience. Writing a resume.

ANS 149 Clerkship at MSU Horse Farm
Management of a working horse farm. Feeding, reproduction, facilities maintenance, and daily management skills.

ANS 200D Introductory Judging of Horses

ANS 240 Horse Farm Management
Integration of principles and skills into a farm management system. Managerial qualities, goal setting, facilities management. Health programs.

ANS 242 Introductory Horse Management
Principles of horse management. Reproduction, nutrition, herd health, genetics, economics, marketing.

ANS 243 Horse Nutrition and Feeding
Nutrient requirements of the horse, selection and evaluation of feedstuffs, balancing diets by hand and by computer, pasture management.

ANS 245 Horse Exercise Physiology
Horse body systems, physiology of exercise and conditioning programs. Goals of various conditioning programs. Common ailments of sport horses.

ANS 295 Livestock Structure and Function
Gross anatomy of livestock. Functions of tissues and organs. Regulation of growth, lactation, reproduction, seasonality, and temperature.

ANS 300D Horse Judging
Evaluation of functional characteristics of horses. Represent MSU in intercollegiate competition. Field trips required.
As the world’s population increases so does the demand for quality food, including pork, which is the “most consumed meat world-wide”. To feed this growing number of people, we will need new scientific technologies and highly-skilled people.

The swine management program is designed to prepare people for careers in modern pork production anywhere in the world. The one-year program judiciously balances “hands-on” training with classroom instruction, in the areas of animal care, nutrition, housing maintenance, swine health, reproduction, records management, environmental management and personnel management. Students also gain practical experience through a summer-long internship on a commercial swine farm in Michigan or beyond. Swine Management graduates will have numerous career opportunities including: farm owners/operator, manager or assistant manager of production (breeding herd, farrowing, nursery grower-finisher, transportation, feeds, marketing), department supervisor, local or regional company representative.

**Suggested Curriculum**

**Fall of First Semester**
- Farm Management I .................................................. ABM 130 3 cr.
- Live Animal and Carcass Evaluation .......................... ANS 211 3 cr.
- Swine Management .................................................. ANS 272 3 cr.
- Swine Clerkship ....................................................... ANS 171 2 cr.
- Technical Math ......................................................... AT 071 2 cr.
- Agriculture Communications ................................. AT 045 2 cr.
- Microcomputers ...................................................... CSS 110 2 cr.
- First Aid and CPR .................................................. AT 098 1 cr.

**Total Credits** ....................................................................................................... 18 credits

**Spring of Second Semester**
- Introductory Animal Agriculture .............................. ANS 110 4 cr.
- Principles of Livestock Feeding ................................. ANS 203 2 cr.
- Livestock Structure and Function ............................ ANS 295 2 cr.
- Principle of Animal Environments .......................... ATM 261 2 cr.
- Ag Facilities Maintenance ....................................... ATM 062 2 cr.
- Placement Training ................................................ AT 099 3 cr.
- Agriculture Communications ................................. AT 045 2 cr.
- Leadership ............................................................. AT 095 2 cr.

**Total Credits** ....................................................................................................... 17 credits

**Program Total** ...................................................................................................... 35 credits
Description of Swine Related Coursework  
INSTITUTE OF AGRICULTURAL TECHNOLOGY

**ANS 110 Introduction Animal Agriculture**  
History of animal agriculture and its relationship to human needs, production systems, marketing, and environmental considerations. Current goals of and limitations affecting U.S. farm animal production.

**ANS 171 Swine Clerkship**  

**ANS 203 Principles of Livestock Feeding**  
Feed nutrients, digestion and metabolism. Classification of feeds. Nutrient requirements for dairy and beef cattle, sheep, swine and horses.

**ANS 211 Animal and Product Evaluation**  
Evaluation of breeding stock, market animals and carcasses. Production records and soundness of breeding animals. Quality grading, yield grading and pricing of market animals and carcasses.

**ANS 272 Introductory Swine Management**  
Swine production principles, practices, technologies, and systems. Field Trips required.

**ANS 295 Livestock Structure and Function**  
Gross anatomy of livestock. Functions of tissues and organs. Regulation of growth, lactation, reproduction, seasonality, and temperature.
ANIMAL SCIENCE FACULTY

ALLEN, MICHAEL S., Ph.D.; 2265 Anthony Hall (432-1386) allenm@msu.edu
B.S., M.S., and Ph.D. from Cornell University. Production, evaluation, and utilization of forages for dairy cattle.

BALANDER, RICHARD J., Ph.D.; 1250 Anthony Hall (432-1395) balander@msu.edu
B.S., University of Virginia; M.S. and Ph.D. from Virginia Tech. Reproductive physiology of domestic poultry, pheasants, and quail. Poultry management. Poultry Science Club Advisor.

BANKS, B. DENNIS, Ph.D.; 1205 Anthony Hall (355-4704) banks@msu.edu
B.S., Middle Tennessee State University; M.S., University of Tennessee; and Ph.D. from Michigan State University. Animal breeding, live animal evaluation. Undergraduate Internship Coordinator.

BATES, RONALD, Ph.D; 1205 Anthony Hall (432-1387) batesr@msu.edu
B.S., Delaware Valley College; M.S. and Ph.D., Oklahoma State University. Swine genetics management.

BEEDE, DAVID K., Ph.D.; 2265 Anthony Hall (355-8437) beede@msu.edu
B.S., Colorado State University; M.S., University of Nebraska-Lincoln; and Ph.D. from University of Kentucky. Meadows Endowed Chair for dairy cattle management.

BLAKE, ROBERT, Ph.D., 1287C Anthony Hall (353-1390) rwblake@msu.edu
B.S., University of Minnesota, M.T.I.D., North Carolina State University, Ph.D., North Carolina State University, International animal science

BURSIAN, STEVEN J., Ph.D.; 2209 Anthony Hall (355-8415) bursian@msu.edu
B.S., University of Michigan; M.S., University of Minnesota; Ph.D. from North Carolina State University. Animal toxicology. ANS Graduate Program Coordinator.

BUSKIRK, DANIEL D., Ph.D.; 2265 Anthony Hall (432-0400) buskirk@msu.edu
B.S. and M.S., Purdue University, Ph.D. from University of Illinois. Beef Cattle Nutrition.

CHOU, KAREN, Ph.D; 2209 Anthony Hall (432-1392) chouk@msu.edu
B.S., Fu-Jen Catholic University; M.S., Michigan State University; Ph.D. from University of Michigan. Toxicology and reproduction.

CIBELLI, Jose B. DVM, PHD; 1230 Anthony Hall (517 432-9602) cibelli@msu.edu
CVM University of La Plata, Buenos Aires, Argentina; PhD University of Massachusetts. Cell biology-nuclear transfer-cloning and embryonic stem cells.

COUSSENS, PAUL M., Ph.D.; B215 Anthony Hall (353-3158) coussens@msu.edu
B.S., Northern Michigan University; M.S., University of Maine; and Ph.D. from Pennsylvania State University. Molecular biology and microbiology.

DOMEQ, JOSEPH J., Ph.D.; 1250 Anthony Hall (353-7855) domecqjo@msu.edu
B.S., California Poly Technic State University; M.S. Virginia Poly Technic Institute and State University; Ph.D. from Michigan State University. Dairy management. Dairy Judging Team Coach.

EHRHARDT, RICHARD, Ph.D.: 1287 Anthony Hall (353-2906) ehrhardt@msu.edu
B.S., University of Wisconsin, M.S. and Ph.D. Cornell University. Extension Specialist, Small ruminant management.
ERNST, CATHY, Ph.D.; 1205 Anthony Hall (432-1941) ernstc@msu.edu
B.S., The Ohio State University; M.S., Iowa State University; Ph.D. The Ohio State University. Quantitative/Molecular genetics of livestock.

FABUS, TAYLOR, M.S.; 1287 Anthony Hall (353-1748) tenlanta@msu.edu
B.S., Michigan State University; M.S., Michigan State University. Equine Youth Extension. Horse Judging Team Coach. Hunt seat Equestrian Team Advisor.

FERRIS, THEODORE A., Ph.D.; 1205 Anthony Hall (355-8442) ferris@msu.edu
B.S., Pennsylvania State University; M.S. and Ph.D. from Michigan State University. Dairy cattle breeding, DHIA records, management.

FOGWELL, ROY, Ph.D.; 1250 Anthony Hall (432-1385) fogwell@msu.edu
B.S. and M.S., University of Maryland; and Ph.D. from West Virginia University. Reproductive physiology and management.

HELESKI, CAMIE, Ph.D.; 1250 Anthony Hall (355-8427) heleski@msu.edu
B.S., M.S. and Ph.D. from Michigan State University. Horse behavior and welfare. Coordinator, Ag Tech Horse Management Program. Horse Judging Team Coach.

HILL, GRETCHEN, Ph.D.; 2209 Anthony Hall (355-9676) hillgre.msu.edu
B.S., University of Kentucky; M.S., Purdue University; and Ph.D. from Michigan State University. Trace element metabolism and interactions. Block & Bridle club Advisor.

IRELAND, JAMES J., Ph.D.; 1230 Anthony Hall (432-1384) ireland@msu.edu
B.S., Austin Peay State University; Ph.D., University of Tennessee; University of Michigan; Senior Fellow, Yale University. Endocrinology and physiology of reproduction.

JOSHI, NANDA, Ph.D.; 2265I Anthony Hall (432-6167) joshin@msu.edu
B.S., India, M.S., Ohio State University, Ph.D., Michigan State University. Animal production systems, animal waste management systems and international agriculture.

KANG, IKSOON (IKE), Ph.D.; 3385B Anthony Hall (355-8452, ext. 203) kangi@msu.edu
B.S., Konkuk University, Seoul/South Korea M.S., California State University, Fresno, Ph.D., Texas A&M University. Food and animal processing.

KARCHER, DARRIN M., Ph.D.; 1287 Anthony Hall (355-8402) dkarcher@msu.edu
B.S., The Ohio State University, M.S., University of Wisconsin-Madison, Ph.D., Purdue University. Poultry nutrition and management.

KARCHER, ELIZABETH, Ph.D.; 1287 Anthony Hall (353-8518) ekarcher@msu.edu
B.S., Pennsylvania State University, M.S., Purdue University; Ph.D. Iowa State University. Dairy cattle nutrition and management.

KNOTT, JASON, Ph.D.; 1230 Anthony Hall (432-5446) knottj@msu.edu
B.S., University of Massachusetts; Ph.D., University of Massachusetts. Developmental and reproductive biology.

LOCK, ADAM L., Ph.D.; 2265 Anthony Hall (353-3714) lockad@msu.edu
B.S., University of Nottingham, UK; Ph.D., University of Nottingham, UK. Extension Specialist, Dairy management.
NIELSEN, BRIAN D., Ph.D.; 1287 Anthony Hall (432-1378) bdn@msu.edu
B.S., University of Wisconsin-River Falls; M.S and Ph.D. from Texas A&M University. Equine nutrition and exercise physiology. Rodeo Club Advisor.

PARTRIDGE, JOHN, Ph.D., 2100B Anthony Hall (355-7713 ext.179) partridge@msu.edu
B.S., University of Vermont, M.S., University of Vermont, Ph.D., Michigan State University, Dairy food processing

POWERS, WENDY, Ph.D.; 2209 Anthony Hall (432-3849) wpowers@msu.edu
B.S. Cornell University; M.S. University of Florida, Ph.D. University of Florida. Environmental issues and nutrition.

PURSLEY, RICHARD, Ph.D.; 1230 Anthony Hall (355-8319) pursley@msu.edu
B.S. and M.S. Kansas State University; Ph.D., University of Wisconsin-Madison. Reproductive physiology.

ROWNTREE, JASON, Ph.D.; 2265 Anthony Hall (432-4906) rowntre1@msu.edu
B.S., Texas A&M University; M.S., Mississippi State University; Ph.D., Michigan State University. Pasture based livestock systems.

ROZEBOOM, DALE, Ph.D.; 2209 Anthony Hall (355-8398) rozeboom@msu.edu
B.S., M.S., and Ph.D. from University of Minnesota. Swine nutrition and management.

RUST, STEVEN D., Ph.D.; 2265 Anthony Hall (432-1390) rust@msu.edu
B.S., University of Wisconsin-River Falls; M.S. and Ph.D. from Oklahoma State University. Beef cattle nutrition and management.

SHELLE, JOHN E., Ph.D.; 1250 Anthony Hall (355-8391) shelle@msu.edu
B.S., M.S., and Ph.D. from Michigan State University. Horse management and nutrition. Horseman’s Association Advisor. Coordinator of ANS Undergraduate Programs.

SIEGFORD, JANICE M., Ph.D.; 2265 Anthony Hall (432-1388) siegford@msu.edu
B.S., Cornell University; M.S., University of Idaho; Ph.D., Washington State University. Animal behavior, animal welfare.

SKELLY, CHRISTINE, Ph.D.; 1287 Anthony Hall skellych@msu.edu
B.S., Texas A&M. University; Ph.D., Texas A&M University. Equine nutrition. MyHorse University.

SMITH, GEORGE, Ph.D.; 1230 Anthony Hall (432-5401) smithge7@msu.edu
B.S., University of Idaho, M.S., Ph.D., University of Missouri. Reproductive physiology.

STEIBEL, JUAN PEDRO, Ph.D.; 1205 Anthony Hall (432-0671) steibeli@msu.edu
B.S., National University of La Pampa; M.S., University of Buenos Aires; Ph.D., Michigan State University. Statistical genetics.

SWANSON, JANICE C., Ph.D.; 2265 Anthony Hall (432-4314) swansoj@anr.msu.edu
B.S., University of Connecticut; M.S., University of Connecticut; Ph.D. University of Maryland. Applied Ethology. Director of Animal Behavior and Welfare. Chairperson

TEMPELMAN, ROBERT, J., Ph.D.; 1205 Anthony Hall (355-8445) tempelma@msu.edu
B.S., M.S., University of Guelph; Ph.D., University of Wisconsin-Madison. Biometrician and animal genetics.
TROTTIER, NATHALIE L., Ph.D.; 2209 Anthony Hall (432-4140) trottier@msu.edu
B.S. and M.S. from McGill University; Ph.D., University of Illinois. Monogastric nutrition.

UTSUMI, SANTIAGO, Ph.D., Kellogg Biological Station (KBS) (269-671-2230)
utsumi@msu.edu Universidad Católica Argentina, M.S., University of Mar del Plata Ph.D., New Mexico State University, Grazing ecology of dairy systems.

VANDEHAAR, MICHAEL J., Ph.D.; 2265 Anthony Hall (355-8489) mikevh@msu.edu 
A.B., Dordt College; M.S. and Ph.D., Iowa State University. Dairy nutrition and nutritional physiology.

WAITE, KAREN L., M.S.; 1287 Anthony Hall (353-1748) kwaite@msu.edu 
B.S. and M.S. from Michigan State University. 4H/Youth horse programs.

WEBER NIELSEN, MIRIAM, Ph.D.; 1250 Anthony Hall (432-5443) msw@msu.edu 
B.S., Michigan State University, M.S. and Ph.D. from Virginia Tech. Dairy management and physiology.

WELLS, SARAH, M.S.; 3385 Anthony Hall (355-8452) welssa@msu.edu 
B.S., The Ohio State University and M.S. South Dakota State University. Applied aspects of meat science. Meat judging team coach.

ZWIERNIK, MATTHEW J., Ph.D.; 3270 Anthony Hall zwiernik@msu.edu 
B.S., Michigan State University; Ph.D., Michigan State University. Environmental toxicology.