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Welcome to the Animal Science Department at Michigan State University! We are looking forward to working with you over the next few years to help you build an exciting program that gives you opportunities in your choice of career. 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: Animal Industries, Animal Biology or Pre-Veterinary Medicine, Companion and Exotic Animal Biology, or Production Animal Scholars. These concentrations lead to a 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.

Our undergraduate program provides a strong science background and the opportunity to work with farm species including, swine, dairy, beef, poultry, sheep, and horses, as well as companion animals. In our Agricultural Technology program, you will focus primarily on developing hands-on, strong management skills. Your Animal Science major will prepare you for the working in the many animal industries, graduate school, or professional school with a strong science background and practical experience. You can 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 Animal Science Undergraduate Research Student Association, Avian Science Club, Block and Bridle Club, Dairy Club, Driving Club, Horsemans Association, Rodeo Club, and the judging teams including meats, dairy, horse, livestock, Dairy Challenge, and animal welfare. You can also participate in international study abroad experiences, internships, or research in laboratories or on our farms to further your career goals. We have researchers working in nutrition, reproductive and developmental biology, animal welfare, nutrient management, genomics, bioinformatics, and bone and joint health in beef cattle, horse, swine, poultry and dairy animals. We are excited that you chose the Department of Animal Science at MSU for your undergraduate education. 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, 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 diverse careers and professional schools such as human and veterinary medicine, 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 in animal agriculture 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 flexibility toward meeting their program requirements and career goals. Students can benefit from guidance by their academic advisors and career mentors as they plan programs of study consistent with their interests and goals. We encourage each student to meet with their advisor or mentor once per semester to discuss course selection, career objectives, and any concerns 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 students section. Other resources can be found on the MSU home page, www.msu.edu. Click on the “Students” tab to find information about academic programs, descriptions of courses, and the 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’s National Institute of Food and Agriculture reported the agricultural, food, and renewable natural resources sectors of the U.S. economy will generate an estimated 54,400 annual openings for individuals with baccalaureate or higher degrees in food, renewable energy, and environmental specialties between 2010 and 2015. The livestock industry and related fields are a major component of the United States and world economy, and career opportunities are excellent for students graduating with an animal science degree.

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 understand animal management and be knowledgeable in animal products, nutrition, genetics, behavior, and physiology. As livestock managers, they must be skilled in marketing, managing the animal's environment, and understanding the normal behavior of animals.
**FOOD INDUSTRY**
The food 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.

**HEALTH INDUSTRY**
Pharmaceutical product companies are seeking bright energetic people to enter their research groups, including testing and product evaluation, sales forces, and consulting agencies dealing with both commercial livestock production and companion animals.

**FEED INDUSTRY**
With the highest cost in livestock and companion animals being feed, this thriving industry has many types of opportunities from product development, sales, research, and technical assistance to advertising and product promotion.

**VETERINARY AND HUMAN MEDICINE**
A baccalaureate degree in animal science provides the foundation in courses needed to apply to professional schools such as veterinary and human medicine. Two concentrations in the Animal Science Department are designed to prepare students to apply to a college of veterinary medicine: Animal Biology and Pre-Veterinary Medicine and Production Animal Scholars. Admission into a college of veterinary medicine is very competitive. Students should strive for academic excellence while developing leadership skills and concurrently developing an alternative career plan.

**COMMODITY, PUBLICATION, AND BREED ORGANIZATIONS**
Breed associations and livestock commodity groups need individuals knowledgeable in a specific or all livestock species and trained with outstanding communication skills. Understanding management and the science of production are essential. Livestock publications, newspapers, television stations, advertising agencies, and public relations firms need talented people who can communicate about animal agriculture.

**BREEDING COMPANIES**
The science of increasing conception in the livestock species is an extremely important part of companies that provide artificial insemination services, embryo and semen harvesting, and embryo transfers. Developing technologies and tools, housing and collecting animals, and sales of semen continue to be part of a growing segment of the livestock industries.

**GOVERNMENT AND AGRICULTURAL BUSINESSES**
Government agencies employ animal science graduates as representatives of their organizations, developing and enforcing policies, and communicating with the public. 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, masters, and doctoral degrees can work in laboratory research or with whole animals. 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 in high school with additional educational courses. Animal science majors may also find employment with the Cooperative Extension Service working as a county educator or as a specialist. People with advanced degrees in animal science are needed to teach in colleges and universities.
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 seek other ANS faculty members as career mentors. 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!**

It is your option to select a different advisor other than the one assigned after AOP. No explanation is required. This is your academic program. If you want to change advisors, 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 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 Justin S. Morrill Hall of Agriculture.

**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 Animal Science, 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 Justin S. Morrill Hall of Agriculture.
## ANIMAL SCIENCE UNDERGRADUATE PROGRAM

**E-MAIL ADDRESSES & TELEPHONE NUMBERS**

### UNDERGRADUATE STUDENT OFFICE (1250 Anthony Hall)

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Email Address</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Shelle</td>
<td>Undergraduate Program Coordinator</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><a href="mailto:richt@msu.edu">richt@msu.edu</a></td>
<td>353-9227</td>
</tr>
<tr>
<td>Gretchen Hill</td>
<td>Internship Coordinator (2290 Anthony Hall)</td>
<td><a href="mailto:hillgre@msu.edu">hillgre@msu.edu</a></td>
<td>355-9676</td>
</tr>
</tbody>
</table>

### ADVISORS FOR BACCALAUREATE PROGRAM

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Location</th>
<th>Email Address</th>
<th>Phone Number</th>
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</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>
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</tr>
<tr>
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<tr>
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<td>432-1378</td>
</tr>
<tr>
<td>John Shelle</td>
<td>Horse</td>
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<td><a href="mailto:shelle@msu.edu">shelle@msu.edu</a></td>
<td>355-8391</td>
</tr>
<tr>
<td>Karen Waite</td>
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<td><a href="mailto:kwaite@msu.edu">kwaite@msu.edu</a></td>
<td>432-0383</td>
</tr>
<tr>
<td>Miriam Weber Nielsen</td>
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<td>1250 Anthony</td>
<td><a href="mailto:msw@msu.edu">msw@msu.edu</a></td>
<td>432-5443</td>
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### ADVISORS FOR AGRICULTURAL TECHNOLOGY

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Location</th>
<th>Email Address</th>
<th>Phone Number</th>
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<tbody>
<tr>
<td>Adam Conover</td>
<td>Beef</td>
<td>1250 Anthony</td>
<td><a href="mailto:aconover@msu.edu">aconover@msu.edu</a></td>
<td>432-4302</td>
</tr>
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<td><a href="mailto:domecqjo@msu.edu">domecqjo@msu.edu</a></td>
<td>353-7855</td>
</tr>
<tr>
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<td>1250 Anthony</td>
<td><a href="mailto:heleski@msu.edu">heleski@msu.edu</a></td>
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</tr>
<tr>
<td>Adam Conover</td>
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<td>1250 Anthony</td>
<td><a href="mailto:aconover@msu.edu">aconover@msu.edu</a></td>
<td>432-4302</td>
</tr>
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</table>

### STUDENT CLUBS AND FARM UNITS

<table>
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<tr>
<th>Club</th>
<th>Location</th>
<th>Email Address</th>
<th>Phone Number</th>
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</thead>
<tbody>
<tr>
<td>Avian Science Club</td>
<td>1250 Anthony</td>
<td></td>
<td>432-1395</td>
</tr>
<tr>
<td>Block &amp; Bridle Club</td>
<td>1275 Anthony</td>
<td></td>
<td>353-5182</td>
</tr>
<tr>
<td>Dairy Club</td>
<td>1272 Anthony</td>
<td></td>
<td>353-3699</td>
</tr>
<tr>
<td>Rodeo Club</td>
<td>1264 Anthony</td>
<td><a href="mailto:rodeo@msu.edu">rodeo@msu.edu</a></td>
<td></td>
</tr>
<tr>
<td>Horsemen’s Association</td>
<td>1265 Anthony</td>
<td></td>
<td>432-2425</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equestrian Team</td>
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<td>Polo Team</td>
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<td>Dressage Team</td>
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<tr>
<td>Driving Club</td>
<td></td>
<td><a href="mailto:msudrivingclub@gmail.com">msudrivingclub@gmail.com</a></td>
<td></td>
</tr>
<tr>
<td>Animal Science Undergrad. Research Student Assoc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef Cattle Research Center</td>
<td>Tristan Foster, Astnt Mgr</td>
<td><a href="mailto:fostert8@msu.edu">fostert8@msu.edu</a></td>
<td>353-2245</td>
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<tr>
<td>Dairy Cattle Research &amp; Teaching</td>
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</tr>
<tr>
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<tr>
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<tr>
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<td><a href="mailto:napolit3@msu.edu">napolit3@msu.edu</a></td>
<td>355-0360</td>
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<tr>
<td>Sheep Teaching &amp; Research</td>
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<td>355-7477</td>
</tr>
<tr>
<td>Pavilion</td>
<td>Scott Rancour, Mgr</td>
<td><a href="mailto:rancour2@msu.edu">rancour2@msu.edu</a></td>
<td>432-5566</td>
</tr>
</tbody>
</table>
FINANCIAL AID AND SCHOLARSHIPS

The Office of Financial Aid, located in Room 259 Student Services Building (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 Justin S. Morrill Hall of Agriculture (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 up to $7,500/year are available to students preparing for careers in the dairy industry. Applications are available in 1250 Anthony Hall. The 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
Tuition scholarships of $1,000 are 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. The deadline for completed applications is early spring.

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. The deadline for completed applications is September 15.

Michigan Dairy Memorial Scholarship Foundation, Inc., Scholarships
Tuition scholarships up to $3,500/year are available to Ag Tech students preparing for careers in dairy science, processing, and/or manufacturing. Applications are available in 1250 Anthony Hall. The deadline is September 30 for completed applications. Applications are available in 1250 Anthony Hall.

C. Additional regional or national scholarships

The CME Group and the National Pork Producers Council Scholarship
Introduced in 1990 to celebrate the 25th Anniversary of Live Hog Futures, the Lois Britt Memorial Pork Industry Scholarship Program continues to recognize outstanding youth in the pork community. 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.

To be eligible you must:

• Be an undergraduate student in a two-year swine program or a four-year college of agriculture;
• Write a brief letter indicating what role you see yourself playing in the pork industry after graduation;
• 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;
• Obtain two letters of reference from current or former professors or industry professionals;
• Prepare a cover sheet with your:
  1. name
  2. complete mailing address and telephone number
  3. school name
  4. year in school
  5. permanent mailing address and telephone number
  6. social security number

Submit all the above items in a single envelope to:
National Pork Producers Council
PO Box 10383
Des Moines, Iowa 50306-9960

Or e-mail to Craig Boelling - boellingc@nppc.org

The National Pork Producers Council (NPPC) will administer the program, read the essays and select the winners. Essays will be judged on the basis of clarity or expression, persuasiveness, originality and relevance of topic. Winners will be announced at the Pork Industry Forum. The CME Group and NPPC reserve the right to publish any or parts of the essays submitted.

For additional information, please contact Craig Boelling at 515-278-8012 or visit their website at: www.nppc.org/programs/scholarships/

Applications are typically due in early December. Please visit their website for updated application instructions and exact deadline date.
Ms. Jill Cords, Career Services and Placement Coordinator, College of Agriculture and Natural Resources, 121 Justin S. Morrill Hall of Agriculture (jcords@msu.edu or 517-355-0234) or MSU’s Career Services Network, 113 Student Services Building, offer excellent programs to assist graduating seniors and employers in finding each other. Every senior should register with the College or the Career Services Network (http://careernetwork.msu.edu/) and become familiar with these programs by the 2nd semester of their junior year. If you wait until the 1st or 2nd semester of your senior year, you will have already missed some of the opportunities. Most interviews take place a semester before graduation.

The ANS department supplements the university and college placement activities in several ways:

1. Students are notified via email as employers contact the Department with job opportunities. Many students find full-time employment with organizations that have employed former students.
2. Representatives from government or industry present seminars to interested students regarding employment opportunities.
3. Academic advisors and mentors are available to discuss career planning and job opportunities at all times.

Many public agencies use Civil Service examination procedures. You should enroll for those tests when they are scheduled for an opening of interest to you. There is often a long lag between the test date and the posting of scores - start early.

Don't wait for someone to call with the job offer. Contact those agencies of most interest to you, give them a resume of your education and work experience, and let them know of your interests and availability. Jobs come to those who are both well prepared and willing to seek the opportunity. During your first year you should develop a resume and update that resume regularly. The resume will be helpful when applying for part-time jobs and will be useful when you graduate.

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 MSU’s Career Services Network. Visit http://careernetwork.msu.edu/ to create an account and see job and internship opportunities that are available. Career Services may also be contacted by visiting their office in 113 Student Services Building or by calling 517-355-9510. Office hours are Monday through Friday, 8:00 am - 5:00 pm.
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 financial support.

Working in ANS research labs is interesting and challenging. Each lab offers a unique experience. Some of the areas in which animal science research is being conducted are dairy, beef, swine, poultry or horse nutrition and behavior, genetics, bioinformatics, reproductive physiology; endocrinology, toxicology, animal behavior, meats, and molecular biology.

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

**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 firsthand knowledge of large scale animal research.

**Assistant Manager:** Tristan Foster 517-353-2245 / fostert8@msu.edu

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

**Assistant Manager:** Tristan Foster 517-355-7452 / fostert8@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.

**Assistant Manager:** Rob West 517-355-7473 / westrobe@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 80 head of Arabian horses, stands stallions for breeding, and utilizes horses for developing student training, handling, and mare management skills. 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 a unique 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, Dorset, and commercial sheep. Student employees work in all aspects of sheep management with 300 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 a 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 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
<table>
<thead>
<tr>
<th>Subject Groups</th>
<th>Contact Person</th>
<th>Phone # (517)</th>
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<tbody>
<tr>
<td>Cellular Reprogramming</td>
<td>Dr. J. Cibelli</td>
<td>432-7065</td>
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<tr>
<td>Molecular Genetics</td>
<td>Dr. C. Ernst</td>
<td>355-8452 ext. 210</td>
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<tr>
<td>Molecular Virology</td>
<td>Dr. P. Coussens</td>
<td>353-7291</td>
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<td>Reproductive Biology</td>
<td>Dr. G. Smith</td>
<td>432-1456</td>
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<td></td>
<td>Dr. J. Ireland</td>
<td>432-1384</td>
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<td>Dr. R. Pursley</td>
<td>432-6178</td>
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<tr>
<td>Horse Research</td>
<td>Dr. B. Nielsen</td>
<td>432-1378</td>
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<tr>
<td>Non-Ruminant Nutrition</td>
<td>Dr. N. Trotter</td>
<td>353-4867</td>
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<td></td>
<td>Dr. G Hill</td>
<td>355-9676</td>
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<tr>
<td>Forage Nutrition</td>
<td>Dr. M. Allen</td>
<td>432-1457</td>
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<tr>
<td>Ruminant Nutrition</td>
<td>Dr. S. Rust</td>
<td>355-3802</td>
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<td>Dr. M. Allen</td>
<td>432-1386</td>
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<td></td>
<td>Dr. D. Buskirk</td>
<td>432-0400</td>
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<tr>
<td>Ruminant Metabolism</td>
<td>Dr. M. Vandehaar</td>
<td>432-1454</td>
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<td>Dr. M. Weber Nielsen</td>
<td>432-5443</td>
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<tr>
<td>Lipid Research</td>
<td>Dr. A. Lock</td>
<td>353-9729</td>
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<td>Toxicology</td>
<td>Dr. S. Bursian</td>
<td>432-1382</td>
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<tr>
<td>Poultry Research</td>
<td>Dr. D. Karcher</td>
<td>775-0485</td>
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<tr>
<td>Animal Behavior</td>
<td>Dr. J. Swanson</td>
<td>432-4134</td>
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<td>Dr. J. Siegford</td>
<td>432-1388</td>
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<td>Dr. C. Heleski</td>
<td>355-8427</td>
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<td>Statistics and Biometrics</td>
<td>Dr. R. Bates</td>
<td>432-1387</td>
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<td>Dr. J. Steibel</td>
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<td>Dr. R. Tempelman</td>
<td>355-8445</td>
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<td>Developmental Epigenetics</td>
<td>Dr. J. Knott</td>
<td>432-7498</td>
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<td>Livestock</td>
<td>Mr. Adam Conover</td>
<td>432-4302</td>
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<tr>
<td>Beef Cattle &amp; Research Center</td>
<td>Mr. Tristan Foster</td>
<td>353-2245</td>
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<tr>
<td>Dairy Teaching &amp; Research Center</td>
<td>Mr. Robert West</td>
<td>355-7473</td>
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<tr>
<td>Horse Teaching &amp; Research Ctr.</td>
<td>Ms. Paula Hitzler</td>
<td>355-7484</td>
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<tr>
<td>Poultry &amp; Mink Research Center</td>
<td>Mr. Angelo Natpolitano</td>
<td>355-0360</td>
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<tr>
<td>Purebred Beef Barn</td>
<td>Mr. Tristan Foster</td>
<td>355-7452</td>
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<tr>
<td>Sheep Teaching &amp; Research Ctr.</td>
<td>Mr. Alan Culham</td>
<td>355-7477</td>
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<tr>
<td>Swine Teaching &amp; Research Ctr.</td>
<td>Mr. Kevin Turner</td>
<td>355-7485</td>
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<tr>
<td>The Pavilion</td>
<td>Mr. Scott Rancour</td>
<td>432-5566</td>
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<tr>
<td>Meats Laboratory</td>
<td>Ms. Jennifer Dominguez</td>
<td>432-0845 x 199</td>
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Seven campus-wide student clubs, which are open to all MSU students, are affiliated with the Department of Animal Science. These Clubs are: The Animal Science Undergraduate Research Student Association (ASURSA), Avian Science Club, Block and Bridle, Dairy Club, Driving Club, Horseman’s Association (Equestrian Teams, Dressage, Polo), and the Rodeo Club. Each organization offers students the opportunity to cultivate their leadership and communication abilities with students having similar interests and concerns. Animal Science faculty and staff serve as the club advisors and 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.

**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: Dr. Nathalie Trottier (432-5140 or trottier@msu.edu) and Dr. Elizabeth Karcher (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 show person. 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.

*Advisors: Ms. Carla McLachlan (432-5402 or mclachl2@msu.edu), Mr. Adam Conover (432-4302 or aconover@msu.edu) and Dr. Dale Rozeboom (355-8398 or rozeboom@msu.edu).*

**Dairy Club**
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.

Advisors: Dr. Adam Lock (353-8714 or alloc@msu.edu) and Ms. Julie Moore (buellj@msu.edu).

**Horsemen’s Association**
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, and fundraising for other equine related students clubs. Advisors: Dr. Karen Waite (432-0383 or kwaite@msu.edu) and Hunt Seat Equestrian Team - Taylor Fabus (353-1748 or tenlenta@msu.edu).

**Driving Club**
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. Advisor: Ms. Cara Robison (353-4866 or oconn107@msu.edu).

**Avian Science Club**
The MSU Avian 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 raise the birds at the Poultry Teaching and Research center and process them at the MSU Meats Laboratory. Advisors: Dr. Richard Balander (432-1395 or balander@msu.edu) and Dr. Darrin Karcher (517-775-0485 or dkarcher@msu.edu).
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 rodeos hosted by a university in the country. 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, 2012, and 2013 IPRA Indoor Rodeo of the Year.

Advisor: Dr. Brian Nielsen (432-1378 or bdn@msu.edu).

ACADEMIC QUADRATHALON

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

Teams of four students compete for university 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 show your knowledge in all areas of animal science. It is an excellent learning experience and enjoyable for all who participate.

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), Taylor Fabus (353-1748)
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 – Adam Conover (432-4302)
ANS 200A section 001 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 section 001 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
ANS 300F Advanced Dairy Farm Evaluation  
Spring Semester – 2 credits

MEAT JUDGING TEAM: Coach –
ANS 200A Introductory Judging of Meat  
Fall Semester - 1 or 2 credits with a maximum of 3 credits
ANS 300A 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 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 them 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 Tracy Rich in 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 is 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

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 when they graduate, making internships even more important. Annually, a large number of ANS majors complete a professional internship with the added benefit of earning a maximum of 6 credit hours toward graduation. Most students complete their internship after reaching
junior or senior class standing and find opportunities in all areas of animal science including livestock production, meat procurement and processing, extension, commodity groups, breed associations, zoological parks, entertainment facilities utilizing animals, finance, marketing, sales, research, and livestock product production. 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 upon completion of the established requirements. Guidelines and requirements for a successful internship may be obtained from Dr. Gretchen Hill (517-355-9676 or hillgre@msu.edu).

STUDY ABROAD

Michigan State University has a long history of international engagement and has led the nation in study abroad participation among public universities for the last six years. MSU’s Office of Study Abroad (OSA) administers over 275 programs taking place in more than 60 countries around the world. Each year, close to 3,000 students are transformed by their educational experiences outside of the United States and can be found in classrooms, research labs, field stations, and internships sites throughout the world.

The Department of Animal Science offers four study abroad programs to introduce students to a variety of cultures and diverse agricultural systems while helping students fulfill their experiential learning requirements.

The Horse Industry of Ireland and Northern Ireland

The differences between the U.S. horse industry and those of Ireland and Northern Ireland will be explored. Students will interact with equine professionals both in the industry and in academic and government institutions.

Ireland and Northern Ireland are countries with a wealth of pastureland and a people with a strong affinity to the horse. The natural beauty of the two countries is seen in their many lakes and waterways, green rolling landscape, hedgerows and stone fences. Castles and historical structures such as churches and state houses dot the landscape, adding to the charm and appeal.

Major breeding, training, racing and schooling farms will be visited and studied. A variety of breeds and disciplines will be represented. Special emphasis will be given to the racing and jumping industries.

The Irish Draft and Connemera breeds were developed in Ireland and will be studied as important contributors to the economics of the Irish horse industry.

Additional studies include rural development programs in both Ireland and Northern Ireland. Comparisons will be made between the two programs and what is available in the United States.

Offered summer semesters, even years.

Dairy Husbandry and Environmental Stewardship

This program focuses on animal agriculture, especially dairy farming, and how economic, environmental, and social policies have affected it. Students will be introduced to the culture and history of the Netherlands and its environmental resources and concerns.

Similarities between animal agriculture in the Netherlands and Michigan will be discussed. Dairy farming in the Netherlands is similar to dairy farming in the Great Lakes region of the United States. Like southern Michigan, the Netherlands has a temperate climate, borders large bodies of water, and has many people coexisting with intensive agriculture. Thus, the challenges in dairy husbandry and environmental stewardship for Michigan and Dutch agriculture are similar.

Student will tour dairy farms, visit agricultural companies, and spend two days living and experiencing
life on a working dairy farm. We will interact with students and faculty from Wageningen University and CAH Dronten.

We will also take time to appreciate the rich Dutch culture. We will visit the Anne Frank House and take a canal ride in Amsterdam, spend the day biking in Wageningen, and view the windmills at historic Groningen. Additionally, we will explore the beautiful cities of Ghent, Belgium and Cologne, Germany.

Offered summer semesters, even years.

**Food, Agriculture and Natural Resource Systems in South Africa and Swaziland**

This program, offered by the department of Animal Science in the College of Agriculture and Natural Resources, will tour the Highvelds and Lowvelds surrounding Johannesburg, Pretoria, Pietersburg, Durban, Port Elizabeth, Mossel Bay, Stellenbosch, and Cape Town in South Africa, and Mbabane in Swaziland. Students will earn six credits while visiting several national parks, including Kruger, and meeting with government officials and university/college representatives, as well as with the agriculture society.

The course of study will focus on exposing students to agriculture production and policy. Students will be exposed to economic development, rural sociology, and environmental issues as they relate to agricultural development. A significant component of the program will consist of visiting some of southern Africa’s noted universities and colleges, such as the University of the North and Stellenbosch University.

During the program, students will familiarize themselves with some of the agriculture and economic challenges in the southern region of Africa. Students will visit with farm families and discuss issues that affect their daily lives. They may also visit food processing plants, commercial livestock facilities, and small-scale fruit and vegetable facilities.

Offered summer semesters, even years.

**Emerging Issues and Sustainability in International Agriculture in Vietnam**

This program focuses on emerging issues and sustainability in international agriculture. Global animal protein intake rates are anticipated to increase between now and 2050 because as household income increases the amount of animal protein intake increases as well. At the same time, there are continuing global challenges to livestock and poultry producers including access to international markets, global competitiveness, and the impact of world politics.

Vietnam is not unlike many other tropical and sub-tropical regions of the developing world in that there is a strong desire to increase animal protein consumption through domestic production. As Vietnamese animal agriculture undergoes its expansion a unique opportunity is presented to work with and learn from the Vietnamese on common issues such as environmental and social concerns related to large-scale animal agriculture production. Students will be introduced to the culture and history of the Vietnam and its environmental resources and concerns.

Students will visit agricultural operations and interact with local producers. We will also have discussions with faculty and students from Agricultural Universities as well as visit with leading agricultural companies.

In addition to the opportunity to study agriculture, Vietnam offers a rich cultural history. Students traveling on this program will have the opportunity to visit Hanoi, explore pagodas and the Imperial citadel in Hue, and cruise down the Ha Long Bay.

Offered summer semesters, odd years.

*For more information and application deadlines, please visit OSA’s website at studyabroad.isp.msu.edu or visit their office located in room 109 International Center.*
Academic Programs in Animal Science (ANS)

Core Courses
(Required for all students)
Page 23

Academic Concentration
(Select One)

- Animal Industry
  Page 24
- Animal Biology or Pre-Veterinary Medicine
  Page 25
- Companion and Exotic Animal Biology
  Page 26
- Production Animal Scholars
  Pages 27 & 28

Bachelor of Science in Animal Science
## University Requirements

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

*WRA is a prerequisite for IAH courses.

## College Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Courses</th>
<th>Semester</th>
<th>Cr</th>
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<tbody>
<tr>
<td>EC 201 or 202</td>
<td>Economics</td>
<td>F,S,SS</td>
<td>3</td>
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<tr>
<td>MTH 116</td>
<td>College Algebra &amp; Trigonometry</td>
<td>F,S,SS</td>
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<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>
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## Department Requirements

### Professional Development in Animal Science I
- ANS 101
- ANS 110
- ANS 301
- ANS 313
- ANS 314
- ANS 315
- ANS 401
- CEM 141
- CEM 143
- BS 161
- BS 171

**TOTAL CREDITS 8**

### Course Options
- BS 161
- BS 171

**TOTAL CREDITS 2-3**

### Statistical Methods
- STT 200
- STT 201
- STT 421

**TOTAL CREDITS 3**

### One of the Following Species Management Courses
- ANS 222
- ANS 232
- ANS 242
- ANS 252
- ANS 262
- ANS 272
- ANS 282

For Production Animal Scholars ANS 242 and 282 are excluded.

**TOTAL CREDITS 3**

### One of the Following Concentrations:

- Animal Industry
- Animal Biology and Pre-Veterinary Medicine
- Companion and Exotic Animal Biology
- Production Animal Scholars

**TOTAL CREDITS 120**

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</th>
<th>DESCRIPTION</th>
<th>TERM</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>ANS 201</td>
<td>Animal Products</td>
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**ONE OF THE FOLLOWING COURSES:**

<table>
<thead>
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<th>DESCRIPTION</th>
<th>TERM</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>CSS 110</td>
<td>Computer Applications in Agronomy</td>
<td>F, S, SS</td>
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<tr>
<td>CSE 101</td>
<td>Introduction to Computing</td>
<td>F, S, SS</td>
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**TOTAL CREDITS 3**

<table>
<thead>
<tr>
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<tr>
<td>ABM 100</td>
<td>Decision-making in the Agri-Food System</td>
<td>F, S</td>
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<tr>
<td>ABM 130</td>
<td>Farm Management I</td>
<td>F</td>
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**ONE OF THE FOLLOWING COURSES:**

<table>
<thead>
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<th>COURSE</th>
<th>DESCRIPTION</th>
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<th>CREDITS</th>
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<tbody>
<tr>
<td>ANS 222</td>
<td>Introductory Beef Cattle Management</td>
<td>S</td>
<td>3</td>
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<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>
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<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>
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</table>

**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</th>
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<th>CREDITS</th>
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<tbody>
<tr>
<td>ANS 422</td>
<td>Advanced Feedlot Management</td>
<td>F</td>
<td>3</td>
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<tr>
<td>ANS 432</td>
<td>Advanced Dairy Management</td>
<td>F</td>
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<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>
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**TOTAL CREDITS 3**

<table>
<thead>
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<th>CREDITS</th>
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<tbody>
<tr>
<td>ANS 211</td>
<td>Animal and Product Evaluation</td>
<td>F</td>
<td>3</td>
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<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 409</td>
<td>Advancements in Reproduction</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>
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<tr>
<td>ANS 413</td>
<td>Monogastric Animal Nutrition</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>ANS 418</td>
<td>Comprehensive Nutrient Management</td>
<td>F</td>
<td>3</td>
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<tr>
<td>ANS 435</td>
<td>Mammary Physiology</td>
<td>S</td>
<td>4</td>
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<tr>
<td>ANS 445</td>
<td>Equine Exercise Physiology</td>
<td>F</td>
<td>4</td>
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<tr>
<td>ANS 455</td>
<td>Avian Physiology</td>
<td>S</td>
<td>4</td>
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<tr>
<td>ANS 483</td>
<td>Ruminant Nutrition</td>
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**SIX CREDITS OF THE FOLLOWING COURSES**

<table>
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<th>COURSE</th>
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<th>CREDITS</th>
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<tbody>
<tr>
<td>ANS 493</td>
<td>Professional Internship</td>
<td>F, S, SS</td>
<td>3</td>
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<tr>
<td>ANS 300A, B, C, D or E</td>
<td>Judging</td>
<td>F</td>
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<td>Study Abroad</td>
<td></td>
<td></td>
<td>6</td>
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**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 Title</th>
<th>Term(s)</th>
<th>Credits</th>
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</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>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>BMB 401</td>
<td>Biochemistry</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>BS 162</td>
<td>Organisms and Populations</td>
<td>F,S,SS</td>
<td>4</td>
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<tr>
<td>BS 172</td>
<td>Organisms and Populations laboratory</td>
<td>F,S,SS</td>
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**TOTAL CREDITS: 23**

### SEVEN CREDITS OF THE FOLLOWING COURSES:

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<tbody>
<tr>
<td>ANS 409</td>
<td>Advancements in Reproduction</td>
<td>F</td>
<td>3</td>
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<tr>
<td>ANS 413</td>
<td>Monogastric Animal Nutrition</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 483</td>
<td>Ruminant Nutrition</td>
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**TOTAL CREDITS: 7-11**

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

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<th>Credits</th>
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<tbody>
<tr>
<td>ANS 305</td>
<td>Applied Animal Behavior</td>
<td>S</td>
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<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>
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<td>*MMG 302</td>
<td>Introductory Microbiology Laboratory</td>
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<td>*MMG 409</td>
<td>Eucaryotic Cell Biology <strong>See Note 1 Below</strong></td>
<td>S,SS</td>
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<tr>
<td>PHM 450</td>
<td>Introduction to Chemical Toxicology</td>
<td>S</td>
<td>3</td>
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<tr>
<td>*PHY 231</td>
<td>Introductory Physics I</td>
<td>F,S,SS</td>
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<td>*PHY 232</td>
<td>Introductory Physics II</td>
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<td>*PHY 251</td>
<td>Introductory Physics Laboratory I</td>
<td>F,S,SS</td>
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<tr>
<td>*PHY 252</td>
<td>Introductory Physics Laboratory II</td>
<td>F,S,SS</td>
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<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</td>
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**TOTAL CREDITS: 8-15**

### ONE OF THE FOLLOWING COURSES:

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<tr>
<td>ANS 492</td>
<td>Undergraduate Research</td>
<td>F,S,SS</td>
<td>3</td>
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<tr>
<td>ANS 493</td>
<td>Professional Internship in ANS</td>
<td>F,S,SS</td>
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<tr>
<td>Study Abroad</td>
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**TOTAL CREDITS: 3-6**

---

**Note 1: These Animal Science courses have been approved to be used in place of MMG 409: ANS 435, ANS 445, and ANS 455 for admission to MSU’s College of Veterinary Medicine.**

ANS Majors must also complete requirements on Page 23 along with their selected concentration.
COMPANION AND EXOTIC ANIMAL BIOLOGY CONCENTRATION

ALL OF THE FOLLOWING COURSES:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ANS 282</td>
<td>Companion Animal Biology and Management</td>
<td>F,S</td>
<td>3</td>
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<tr>
<td>BS 162</td>
<td>Organisms and Populations</td>
<td>F,S,SS</td>
<td>4</td>
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<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>
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</tr>
<tr>
<td>CEM 255</td>
<td>Organic Chemistry Lab</td>
<td>F,S,SS</td>
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<tr>
<td>ZOL 328</td>
<td>Comparative Anatomy and Biology of Vertebrates</td>
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TOTAL CREDITS 18

ONE OF THE FOLLOWING COURSES:

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<th>Credits</th>
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<tbody>
<tr>
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<td>F,S,SS</td>
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</tr>
<tr>
<td>BMB 401</td>
<td>Basic Biochemistry</td>
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TOTAL CREDITS 4

SIX CREDITS OF THE FOLLOWING COURSES:

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<th>Course Title</th>
<th>Term</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ANS 305</td>
<td>Applied Animal Behavior</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>ANS 409</td>
<td>Advancements in Reproduction</td>
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<td>3</td>
</tr>
<tr>
<td>ANS 413</td>
<td>Monogastric Animal Nutrition</td>
<td>F</td>
<td>3</td>
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<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>
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TOTAL CREDITS 6-8

ELEVEN CREDITS OF THE FOLLOWING COURSES:

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<tbody>
<tr>
<td>ANS 407</td>
<td>Food and Animal Toxicology</td>
<td>F</td>
<td>3</td>
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<tr>
<td>ANS 418</td>
<td>Comprehensive Nutrient Management</td>
<td>F</td>
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<tr>
<td>ANS 425</td>
<td>Principles of Animal Biotechnology</td>
<td>S</td>
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<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,S,SS</td>
<td>3</td>
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<tr>
<td>ZOL 341</td>
<td>Fundamental Genetics (Can replace ANS 314)</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
<tr>
<td>ZOL 355</td>
<td>Ecology</td>
<td>F,S,SS</td>
<td>3</td>
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<tr>
<td>ZOL 369</td>
<td>Introduction to Zoo and Aquarium Science</td>
<td>S</td>
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TOTAL CREDITS 11-16

ONE OF THE FOLLOWING COURSES:

<table>
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<td>ANS 492</td>
<td>Undergraduate Research</td>
<td>F,S,SS</td>
<td>3</td>
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<tr>
<td>ANS 493</td>
<td>Professional Internship in ANS</td>
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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>
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<th>Term(s)</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ANS 201</td>
<td>Animal Products</td>
<td>F</td>
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<tr>
<td>BS 162</td>
<td>Organisms and Populations</td>
<td>F,S,SS</td>
<td>4</td>
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<tr>
<td>BS 172</td>
<td>Organisms and Populations Laboratory</td>
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<tr>
<td>CEM 161</td>
<td>Chemistry Laboratory I</td>
<td>F,S,SS</td>
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<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>BMB 401</td>
<td>Biochemistry</td>
<td>F,S,SS</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 <strong>See Note 1 on page 28</strong></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>Monogastric Animal Nutrition</td>
<td>F</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**

**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 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 409</td>
<td>Advancements in Reproduction</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 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>
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</tbody>
</table>

Production Animal Scholars continues on the next page
Production Animal Scholars, Continued

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Offered</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<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,S,SS</td>
<td>3</td>
</tr>
<tr>
<td>ZOL 341</td>
<td>Fundamental Genetics (Can replace ANS 314)</td>
<td>F,S,SS</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 2**

**Note 1: These Animal Science courses have been approved to be used in place of MMG 409: ANS 435, ANS 445, and ANS 455 for admission to MSU’s College of Veterinary Medicine.**

ANS Majors must also complete requirements on Page 23 along with their selected concentration.

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-professional students this is a different path with no competitive advantage for acceptance into professional school such as medicine or veterinary medicine.

**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 complete a maximum of six courses, and all credits transfer to MSU to meet graduation requirements. Some courses may be used to fulfill requirements in Animal Science. 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 their own in-state tuition.
CANR Specializations and Minors

While completing the requirement for a degree in Animal Science, students may use their elective credits to complete a specialization in the College of Agriculture and Natural Resources. Currently, there are specializations in biotechnology and agribusiness management. Additionally, the Departments of Plant, Soil, and Microbial Sciences and Food Science and Human Nutrition have minors meeting the needs of many animal science majors.

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 provides the opportunity for students who are enrolled in biological science–related undergraduate programs to become familiar with the concepts, techniques, and issues related to modern biotechnology. 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 Justin S. Morrill Hall of Agriculture for information on how to enroll for the specialization.

**This specialization may transition to a minor. For updates to requirements, please visit the department website: http://www.canr.msu.edu/undergraduate**

Requirements:

**ALL OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Semester(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 7**

**ONE OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Semester(s)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS 314</td>
<td>Genetic Improvement of Domestic Animals</td>
<td>S</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</th>
<th>Title</th>
<th>Semester(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 3-4**

**ANS Majors must complete requirements on Page 23, the requirements for their selected concentration, and the above requirements for this specialization.**
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.

**This specialization is transitioning to a minor. For updates, please visit the department website:**

http://www.afre.msu.edu/undergraduate

Total credits for specialization = 18

<table>
<thead>
<tr>
<th>REQUIREMENTS</th>
<th>Cr</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semesters Offered</strong></td>
<td>FS</td>
<td>SS</td>
</tr>
</tbody>
</table>

**One of the following:**

| ACC 201 | Principles of Financial Accounting | 3 | None; not open to freshmen | ✔ | ✔ | ✔ |
| ACC 230 | Survey of Accounting Concepts | 3 | None; not open to freshmen | ✔ | ✔ | ✔ |

**One of the following:**

| ABM 100 | Decision-Making in Agri-Food System | 3 | None | ✔ | ✔ |
| ABM 130 | Farm Management I | 3 | None | ✔ |

**One of the following:**

| ABM 225 | Commodity Marketing I | 3 | ABM 100 or EC 201 | ✔ |
| ABM 430 | Farm Management II | 3 | ABM 130; Jr or Sr status | ✔ |
| ABM 435* | Financial Management in the Agri-Food System | 3 | (ACC 230 or 201) and (ABM 130 or 100 or EC 201 or 202) recommended but not required; Jr or Sr status required | ✔ |

**TWO of the following, including at least one at the 300 or 400 level:**

*Note: Food Industry Mgt. majors must choose one course that does NOT also fulfill any FIM degree requirements.*

| ABM 222 | Agribusiness & Food Industry Sales | 3 | ABM 100 or ABM 130 or EC 201 or EC202; completion of Tier I (WRA) writing course; Soph, Jr, or Sr status | ✔ | ✔ | ✔ |
| ABM 337 | Labor and Personnel Mgt. in the Agri-Food System | 3 | ABM 100 or ABM 130 or HRT 404; Jr or Sr status | ✔ |
| ABM 400 | Public Policy Issues in the Agri-Food System | 3 | ABM 100, Jr or Sr status | ✔ |
| ABM 422 | Vertical Coordination in the Agri-Food System | 3 | ABM 100 and EC 201; Jr or Sr status | ✔ |
| ABM 425 | Commodity Marketing II | 3 | ABM 225 and (STT 200 or 201 or 315 or ANS 314 or CSS 350 or concurrently) | ✔ |
| ABM 427 | Global Agri-Food Industries & Markets | 3 | FIM 220 or ABM 225 | ✔ |
| ABM 435* | Financial Management in the Agri-Food System | 3 | Recommended: (ACC 201 or 230) and (ABM 100 or 130 or EC 201 or 202); Jr or Sr status required | ✔ |
| ABM 437 | Agribusiness Strategic Management or FIM 439 Food Business Analysis and Strategic Planning | 3 | FIM 220, ABM 435, and ABM 430; completion of Tier I (WRA) writing requirement; Sr status | ✔ |

Non-ABM majors should see an ABM Advisor to plan for prerequisites for this course

ABM 100, ABM 130, ABM 225, and ABM 430 may be used here if not used to fulfill requirements above

<table>
<thead>
<tr>
<th>One of the following:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GBL 323</td>
<td>Introduction to Business Law</td>
</tr>
<tr>
<td>MGT 325</td>
<td>Management Skills &amp; Processes</td>
</tr>
<tr>
<td>MKT 327</td>
<td>Introduction to Marketing</td>
</tr>
</tbody>
</table>

*ABM 435 can only be used once in either the “choose one” or the “choose two” category.*

To apply for the Specialization, contact Ellen Schueller, schuell2@msu.edu or call 353-4519, Rm. 1, Justin S. Morrill Hall of Agriculture

ANS Majors must complete requirements on Page 23, the requirements for their selected concentration, and the above requirements for this specialization.
Minor in Agronomy

The Minor in Agronomy is designed to serve students with majors in fields other than Crop & Soil Sciences who are interested in agronomy and who plan to pursue careers in agriculture for which a basic familiarity with the science of cropping systems is important. The minor will provide an opportunity for students to gain a fundamental understanding of the science of food production, including crop management, soil management, and plant breeding and biotechnology. For additional information, please contact Dr. Karen Renner (517-355-0271 x1233 or renner@msu.edu).

Minor in Agronomy Requirements:

ALL OF THE FOLLOWING COURSES (9 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 101</td>
<td>Introduction to Crop Sciences</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>CSS 210</td>
<td>Fundamentals of Soil Science</td>
<td>F, S</td>
<td>3</td>
</tr>
<tr>
<td>CSS 488</td>
<td>Agricultural Cropping Systems</td>
<td>S</td>
<td>3</td>
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</tbody>
</table>

TOTAL CREDITS 9

ONE OF THE FOLLOWING COURSES (2 or 3 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 222</td>
<td>New Horizons in Biotechnology</td>
<td>F</td>
<td>2</td>
</tr>
<tr>
<td>CSS 350</td>
<td>Introduction to Plant Genetics</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>CSS 441</td>
<td>Plant Breeding and Biotechnology</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 2-3

ONE OF THE FOLLOWING COURSES (2 or 3 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 135</td>
<td>Crop Scouting and Investigation</td>
<td>S</td>
<td>2</td>
</tr>
<tr>
<td>CSS 151</td>
<td>Seed and Grain Quality</td>
<td>S</td>
<td>2</td>
</tr>
<tr>
<td>CSS 201</td>
<td>Forage Crops</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>CSS 212</td>
<td>Advanced Crop Production</td>
<td>F</td>
<td>2</td>
</tr>
<tr>
<td>CSS 251</td>
<td>Organic Farming Principles and Practices</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CSS 302</td>
<td>Principles of Weed Management</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>CSS 424</td>
<td>Sustainable Agriculture and Food Systems</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>CSS 431</td>
<td>International Agricultural Systems</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>CSS 467</td>
<td>Bioenergy Feedstock Production</td>
<td>F</td>
<td>3</td>
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</table>

TOTAL CREDITS 2-3

ONE OF THE FOLLOWING COURSES (2 or 3 credits):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 330</td>
<td>Soil Chemistry</td>
<td>S</td>
<td>2</td>
</tr>
<tr>
<td>CSS 340</td>
<td>Applied Soil Physics</td>
<td>S</td>
<td>2</td>
</tr>
<tr>
<td>CSS 360</td>
<td>Soil Biology</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>CSS 470</td>
<td>Soil Resources</td>
<td>F</td>
<td>3</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 2-3

ANS Majors must complete requirements on Page 23, the requirements for their selected concentration, and the above requirements for this minor.
Minor in Nutritional Sciences

The Minor in Nutritional Sciences, which is administered by the Department of Food Science and Human Nutrition, will broaden students’ understanding of the science of nutrition and the relationships between food and health. The minor is available as an elective to students who are enrolled in bachelor’s degree programs at Michigan State University other than the Bachelor of Sciences Degree in Nutritional Sciences or the Bachelor of Science Degree in Dietetics. Students who plan to complete the requirements for the 16 credit minor should consult advisor Dr. Jennifer Ekstrom at ekstrom@msu.edu.

Minor in Nutritional Sciences Requirements:

**ONE OF THE FOLLOWING COURSES (3 credits):**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Terms</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>HNF 150</td>
<td>Introduction to Human Nutrition</td>
<td>F, S, SS</td>
<td>3</td>
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<tr>
<td>HNF 260</td>
<td>Principles of Human Nutrition (Prerequisites)</td>
<td>F, S</td>
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**COMPLETE 13 CREDITS OF THE FOLLOWING COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Terms</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HNF 375</td>
<td>Community Nutrition</td>
<td>F, SS</td>
<td>3</td>
</tr>
<tr>
<td>HNF 461</td>
<td>Adv. Human Nutrition: Carbohydrates, Lipids and Proteins</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>HNF 462</td>
<td>Advanced Human Nutrition: Vitamins and Minerals</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>HNF 464</td>
<td>Nutrition in the Prevention and Treatment of Disease</td>
<td>S</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS 32**

ANS Majors must complete requirements on Page 23, the requirements for their selected concentration, and the above requirements for this minor.
101 Professional Development Animal Science I. Fall and Spring 1 credit.
Careers in animal science. Job application, portfolio development, interviewing, and resume development.

110 Introductory Animal Agriculture. Fall and Spring 4 credits.

140 Fundamentals of Horsemanship. Fall and Spring 2 credits.
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 credits.
Safe handling, hitching and driving of draft horses. Care and maintenance of harness and horse drawn equipment.

142 Horse Training for Competition. Summer 2 credits.
Implementation of training techniques to prepare horses for State competitions. Exhibiting horses in competitions. Field trips required.

200A (Section 001) Introductory Judging of Livestock. Spring 01-2 credits.

200A (Section 002) Introductory Judging of 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 credit.
Physiological and behavioral indicators of animal welfare. Quantitative measures and ethical issues. Written and oral assessments of animal welfare.

200F Dairy Farm Evaluation. Fall 1 credit.
Evaluation of dairy farm management. Preparation for collegiate competition. Field trip required.

201 Animal Products. Fall 3 credits.
Edible animal products. Processing, preservation, storage, and distribution of dairy, meat, and egg products.

201L Animal Products Laboratory. Fall 1 credit.
Processing and evaluation of meat, milk and egg products.
211 Animal and Product Evaluation. Fall 3 credits.
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.

222 Introductory Beef Management. Spring 2 credits.
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 credits.
Natural behavior, senses, training, psychology, and common behavioral problems in horses. Equine welfare issues.

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

242 Introductory Horse Management. Fall 3 credits.
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 credits.
Management of commercial poultry flocks and aviaries. Feed requirements, reproduction, breeding, housing and disease.

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

272 Introductory Swine Management. Fall 3 credits.
Swine production principles, practices, technologies, and systems. Field trips required.

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

300A (Section 01) Advanced Livestock Judging. Fall 2 credits.
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. Fall 2 credits.
Evaluation of beef, pork, and sheep. Represent MSU in intercollegiate competition. Field trips required.

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

300D Advanced Horse Judging. Fall 2 credits.
Evaluation of functional characteristics of horses. Represent MSU in intercollegiate competition. Field trips required.

300E Animal Welfare Judging. Fall 1 credit.
Enhanced understanding of the physiological and behavioral indicators of animal welfare. Ethical values in the assessment of welfare status. Intercollegiate competition. Field trip required.
300F  Advanced Dairy Farm Evaluation. Spring. 2 credits.
Evaluation of factors important in successful management of a dairy farm business. Represent Michigan State University in intercollegiate competition. Field trips required.

301  Professional Development in Animal Science II. Fall and Spring 2 credits.

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

309  Animal Health Management. Fall 3 credits.

313  Principles of Animal Feeding and Nutrition. Fall 4 credits.

314  Genetic Improvement of Farm Animals. Spring 4 credits.
Molecular, Mendelian, population, and quantitative genetics of domestic animals.

315  Anatomy and Physiology of Farm Animals. Spring 4 credits.

401  Ethical Issues in Animal Agriculture. Spring 1 credits.
Societal issues related to local, national and international animal agriculture.

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

409  Advancements in Reproduction. Fall 3 credits.
Selected topics in endocrine, cellular, molecular and genetic aspects of sex differentiation, gametogenesis, folliculogenesis, sexual cycles, behavior, fertilization, early embryo development, pregnancy, parturition, infertility, reproductive disorders, assisted reproductive technologies in humans, livestock and animal models.

413  Monogastric Animal Nutrition. Fall 3 credits.
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 credits.
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 credits.
Feedlot management systems and issues. Feed systems, manure management, health maintenance, and cattle marketing. Field trips required.

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 credits.
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.

430  Dairy Systems Management. Spring 3 credits.
Decision-making strategies for dairy farms. Emphasis on herd replacements, personnel, health, facilities, nutrient management and other issues associated with dynamic markets and business environments. Field trips required.

432  Advanced Dairy Cattle Management. Fall 3 credits.
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 credits.

442  Advanced Horse Management. Spring 3 credits.
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 credits.
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 credits.
Systemic and comparative physiology of birds. Respiration, reproduction, endocrinology, digestion, urination, and the senses.

472  Advanced Swine Management. Spring even years 3 credits.
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 credits.
Animal Systems in various global regions. Output, land and resource conservation, and socioeconomic factors.

483  Ruminant Nutrition. Spring 3 credits.
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 credits.
Faculty supervised research in selected areas of animal science.

493  Professional Internship in Animal Science. Fall, Spring, and Summer 3 credits.
Supervised professional experience in the animal industry.
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.
DAIRY PRODUCTION
INSTITUTE OF AGRICULTURAL TECHNOLOGY

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 dairy 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 .................................................................................................... 14 cr.

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
Mammary anatomy and growth. Immunization and biosecurity. Lactation and mastitis. Transition into
lactation.

ANS 230 Dairy Herd Management
Analysis of dairy farm management. Investigation and problem solving. Collecting data and formulating
conclusions and recommendations. Oral presentation.

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
Feeding management of dairy cattle with emphasis on milking cows and replacements. Cost

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.
This certificate program 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 (F) .................................................. ABM 130 3 cr.
- Animal and Product Evaluation (F) .................................. ANS 211 3 cr.
- Feedlot Clerkship (F) ...................................................... ANS 122A 2 cr.
- Computer Applications in Agronomy (F,S) ......................... CSS 110 2 cr.
- Agricultural Communications (F) ...................................... AT 045 2 cr.
- Technical Mathematics (F) .............................................. AT 071 2 cr.
- Electives ........................................................................ 3 cr.

**Total Credits ........................................................................................................... 17 cr.**

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

**Total Credits ........................................................................................................... 19 cr.**

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

### Suggested Electives

- Decision Making in the Agri-Food System (F,S) ............. ABM 100 3 cr.
- Introductory Horse Management (F) ............................... ANS 242 3 cr.
- Introductory Sheep Management (S) ............................... ANS 262 3 cr.
- Introductory Swine Management (S) ............................... ANS 272 3 cr.
- Agricultural Finance (S) ................................................. AT 055 2 cr.
- Introduction to Crop Science (F) .................................... CSS 101 3 cr.
- Forage Crops (F) ............................................................ CSS 201 3 cr.

* May be taken during summer term and electives put into schedule.
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 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 ................................................ ANS 146 2 cr.
- Horsemanship II Section 002 ..................................................... ANS 140
- 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 (F) ................................................................. ABM 130 3 cr.
- Live Animal and Carcass Evaluation (F) ......................................... ANS 211 3 cr.
- Swine Management (F) .................................................................. ANS 272 3 cr.
- Swine Clerkship (F) ........................................................................ ANS 171 2 cr.
- Technical Math (F) ......................................................................... AT 071 2 cr.
- Agriculture Communications (F) ................................................... AT 045 2 cr.
- Computer Application in Agronomy (F,S) ........................................ CSS 110 2 cr.

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

**Spring of Second Semester**

- Introductory Animal Agriculture (F,S) ............................................. ANS 110 4 cr.
- Principles of Livestock Feeding (S) ................................................ ANS 203 2 cr.
- Livestock Structure and Function (S) ............................................ ANS 295 2 cr.
- Agricultural Finance (S) ................................................................. AT 055 2 cr.
- Professional Internship in Ag Technology* ................................... AT 293 6 cr.
- Elective ......................................................................................... 2 cr.

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

**Program Total** .................................................................................. 35 credits

**Suggested Electives**

- Decision Making in the Agri-Food System (F,S) ....................... ABM 100 3 cr.
- Introductory Horse Management (F) ........................................... ANS 242 3 cr.
- Introductory Sheep Management (S) ............................................ ANS 262 3 cr.
- Introduction to Crop Science (F) ................................................. CSS 101 3 cr.
- Forage Crops (F) ........................................................................... CSS 201 3 cr.
- Selected Topics in Ag Tech (S) ..................................................... AT 291 2 cr.
- Independent Study ....................................................................... AT 290 2 cr.

* May be taken during summer term and electives put into schedule.
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.

BATES, RONALD, Ph.D.; 1205 Anthony Hall (432-1387) batesr@msu.edu
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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.

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BURSIAN, STEVEN J., Ph.D.; 2209 Anthony Hall (355-8415) bursian@msu.edu
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CONOVER, ADAM, M.S.; 1250 Anthony Hall (432-4302) aconover@msu.edu
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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  
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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.

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B.S., University of Kentucky; M.S., Purdue University; and Ph.D. from Michigan State University. Trace element metabolism and interactions. Coordinator of Undergraduate Internships.

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B.S., India, M.S., Ohio State University, Ph.D., Michigan State University. Animal production systems, animal waste management systems and international agriculture.

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B.S., Pennsylvania State University, M.S., Purdue University; Ph.D. Iowa State University. Dairy cattle nutrition, management, and health. Advises the Animal Science Undergraduate Research Student Association.

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B.S., University of Kentucky; Ph.D., University of Virginia; Postdoctoral Research, The Wistar Institute, Philadelphia, PA.

LOCK, ADAM L., Ph.D.; 2265 Anthony Hall (353-3714) lockad@msu.edu  
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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.
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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
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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.

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SHELLE, JOHN E., Ph.D.; 1250 Anthony Hall (355-8391) shelle@msu.edu
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SKELEY, CHRISTINE, Ph.D.; 1287 Anthony Hall skellych@msu.edu
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STEIBEL, JUAN PEDRO, Ph.D.; 1205 Anthony Hall (432-0671) steibel@msu.edu
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