The department emphasizes in vivo and in vitro studies that probe relationships at a fundamental mechanistic level as well as addressing current practical issues in animal agriculture. Studies may often employ the use of livestock or laboratory animals, or both, as subjects. Development of an individual course of study is flexible in order to meet the needs of students with varied interests. Graduates find employment in academic teaching and research, in professional veterinary or medical degree programs, in industrial research in the food and feed industries, in laboratory research programs with governmental and international agencies, private corporations, and in industrial or institutional management positions requiring a high level of scientific training.

The department is based in the Animal Sciences Building, which contains facilities for teaching and research, including a Computing and Biometry Laboratory and the Biological and Biomaterials Preparation Imaging and Characterization Facility. Nearby are the Livestock Laboratory, a state-of-the-art facility, and the Muscle Biology Laboratory. Teaching, research, and project assistantships are available to qualified students. Fellowships, scholarships, and traineeship awards are available from federal training programs, research grants, gifts and trusts, and special program funds.

**RESEARCH FOCUS AREAS**

Students may choose to focus on the areas of: nutrition, rumen microbiology, aquaculture, reproductive physiology—endocrinology, genetics, animal breeding, muscle biology, meat science, cell biology, animal health, immunity and toxicology, or international agriculture. Considerable opportunity for study exists in joint programs with bacteriology, toxicology, biochemistry, the interdepartmental graduate program in nutritional sciences, genetics, endocrinology, reproductive physiology training program, food science, physiology, agricultural and applied economics, biometry, cellular and molecular biology, pharmaceutical sciences, chemical and biological engineering, bioengineering, comparative biosciences and anatomy.

The area of nutrition involves a joint degree with the Department of Animal Sciences and the Department of Nutrition Sciences. Usually, students work with professors from both departments so fundamental concepts complement practical applications. Ruminant nutrition candidates often minor or have a joint major in the Department of Bacteriology. Nutritional research ranges from field studies to laboratory biochemical studies.

The endocrinology–reproductive physiology area ranges from hormonal studies with livestock, primates, and laboratory animals to biochemical studies at the cellular level including stem cell biology. These studies include mechanism of gene action, physiological genetics, in vitro maturation, fertilization, embryo development, cloning and gene transfer, neuroendocrinology, and the environmental and genetic control of puberty and postpartum anestrus.

The genetics–animal breeding focus includes a variety of areas from immunogenetics and molecular genetics to quantitative and population genetics. The animal breeding program seeks to develop, evaluate, and apply classical, quantitative, biochemical, and physiological genetics toward improving animal breeding techniques. Studies range from theoretical considerations of quantitative genetics to laboratory experimentation on genetic controls of growth and reproduction, gene transfer and cloning to field experimentation on producer herds and flocks. Candidates may minor in several areas including genetics, statistics, physiology, or biochemistry.

Meat science and muscle biology studies probe the relationship of muscle structure, composition, and metabolism to growth, the contractile function, and meat quality. Similar studies related to adipose tissue are included. This fundamental research is applied to muscle efficiency and improved retail meat quality and composition.

The area of cellular biology, animal health, immunity, and toxicology includes basic research which seeks to develop an understanding of cellular/subcellular structure and function, cell regulation, and cell–cell interactions. Cell function, as it relates to mechanisms of immunity and the effects of natural and synthetic compounds, forms the basis for investigations using in vitro and in vivo, whole animal, model systems. Results of fundamental studies are directly applicable and coordinated with ongoing applied research programs in animal and human health.

**ADMISSIONS**

Students with satisfactory undergraduate training in any biological science including emphasis on basic science courses will have suitable backgrounds for graduate studies in animal science. Typically students admitted to the program have GPAs of 3.2 or higher; candidates with a lower GPA may be considered for admission under special circumstances. Admission decisions are based on academic record, GRE scores, three letters of recommendation, and Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS), if applicable.

Students are admitted to the department if a faculty member agrees to accept the candidate into his or her research group and to provide laboratory/desk space and research support, and upon the approval of the Animal Sciences Graduate Admissions Committee and the Graduate School. The faculty member also makes the decision of whether or not to offer a research assistantship to the candidate. International candidates in the master of science program rarely receive financial support.

**GRADUATE SCHOOL ADMISSIONS**

Graduate admissions is a two-step process between academic degree programs and the Graduate School. Applicants must meet requirements of both the program(s) and the Graduate School. Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/admissions).

**FUNDING**

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding) is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

**PROGRAM RESOURCES**

Financial assistance may be available to qualified individuals in the form of research assistantships, teaching assistantships, or fellowships. Funding does not come from the department, but from the faculty.
member agreeing to advise the new student; therefore students join labs directly instead of doing rotations. Funding is awarded on a competitive basis and may be renewed annually pending satisfactory progress. Terms of these appointments are initially defined in the letter of offer to the student.

**REQUIREMENTS**

**MINIMUM GRADUATE SCHOOL REQUIREMENTS**

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/policiesandrequirementstext), in addition to the program requirements listed below.

**MAJOR REQUIREMENTS**

**MODE OF INSTRUCTION**

<table>
<thead>
<tr>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Mode of Instruction Definitions**

**Evening/Weekend:** These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.

**Online:** These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.

**Hybrid:** These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

**Accelerated:** These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

**CURRICULAR REQUIREMENTS**

<table>
<thead>
<tr>
<th>Minimum Credit Requirement</th>
<th>51 credits</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Minimum Residence Credit Requirement</th>
<th>32 credits</th>
</tr>
</thead>
</table>

| Minimum Graduate Coursework Requirement | Half of degree coursework (26 credits out of 51 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide (https://registrar.wisc.edu/course-guide). |

**REQUIRED COURSES**

All Animal Sciences Ph.D. students must meet with their research committee during their first year to complete their Certification Form (http://www.ansci.wisc.edu/cgstudentt.html). Once the committee has approved the certification paperwork the student must turn in the signed copy to the Graduate Coordinator so that it may be reviewed and approved by the graduate chair. The certification paperwork must be approved before a student can request their prelim warrant. Students should meet with their committee once per year. Any changes to the certification paperwork must be communicated to the graduate coordinator and approved by the graduate chair.

Students graduating with a Ph.D. in animal sciences are expected to have core education in the following areas:

- Physiology/endocrinology/reproduction
- Biochemistry/nutrition
- Genetics/breeding
- Food science/meat science/ food safety/microbiology
- STAT/F&W ECOL/HORT 571 Statistical Methods for Bioscience I, STAT/F&W ECOL/HORT 572 Statistical Methods for Bioscience II, or equivalent
- A course in ethics
- Teaching practicum, with Delta or MIU Workshop training.

Courses taken prior to entering the animal sciences program will be considered as a substitute.

**Seminar Requirement**

The Animal Sciences Graduate seminar features outside speakers, UW faculty, and animal sciences graduate students presenting their research or defending their thesis. This course is held on Tuesday mornings during the fall semester from 11 a.m. to noon. Attendance is required at this
seminar series by all animal sciences graduate students. Ph.D. students are required to register for the AN SCI 875 Special Topics (Animal Science Seminar) for credit twice. Although attendance is required, registering for the seminar for credit is done the semester a student presents.

**Teaching Requirement**
All students in the animal sciences Ph.D. program are required to complete a Teaching Practicum, usually AN SCI 799 Practicum in Animal Sciences Teaching. Each student is expected to work with the faculty advisor to identify an opportunity within the department for the student to engage in teaching. This requirement is broadly defined, and could include assisting an animal sciences faculty member with classroom teaching or TA’ing in a course outside of the animal sciences department.

**Enrollment Requirement**
The department requires all funded students to be enrolled full time. For M.S. students this means at least 8 credits in the fall and spring term and at least 2 credits in the summer term. Students funded by another department should check with the payroll and benefits coordinator of that department to learn their requirements for enrollment. Unfunded students should follow the Graduate School’s rules on enrollment (https://grad.wisc.edu/documents/enrollment-requirements).

The remainder of the course requirements for the Ph.D. in Animal Sciences will be selected to meet the student’s specific needs and to ensure breadth and depth as determined through consultation with his/her major professor and members of their committee.

**Animal Nutrition Track**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN SCI/DY SCI &amp; AN SCI/DY SCI</td>
<td>Ruminant Nutritional Physiology I and Ruminant Nutritional Physiology II</td>
<td></td>
</tr>
<tr>
<td>AN SCI/DY SCI 931</td>
<td>Seminar in Animal Nutrition</td>
<td></td>
</tr>
<tr>
<td>NUTR SCI/BIOCHEM 619</td>
<td>Advanced Nutrition: Intermediary Metabolism of Macronutrients</td>
<td></td>
</tr>
<tr>
<td>NUTR SCI/M&amp;ENVTOX 623</td>
<td>Advanced Nutrition: Minerals</td>
<td></td>
</tr>
<tr>
<td>NUTR SCI 627</td>
<td>Advanced Nutrition: Vitamins</td>
<td></td>
</tr>
<tr>
<td>COMP BIO 506</td>
<td>Veterinary Physiology B</td>
<td></td>
</tr>
<tr>
<td>COMP BIO 551</td>
<td>Veterinary Physiology A</td>
<td></td>
</tr>
</tbody>
</table>

1 These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

2 These degree programs are supported by the Animal Nutrition Emphasis Group in the IGPNS program (https://nutrisci.wisc.edu/graduate/m-s-ph-d/animal-nutrition-emphasis-group). Animal sciences faculty members also have the option of offering an M.S. or Ph.D. degree in nutritional sciences as members of the Animal Nutrition Emphasis Group in IGPNS.

**Endocrinology & Reproductive Physiology Track**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN SCI 875</td>
<td>Special Topics (Endocrine Physiology)</td>
<td></td>
</tr>
<tr>
<td>BIOCHEM/PHMCOL-M/ZOOLOGY 630</td>
<td>Cellular Signal Transduction Mechanisms</td>
<td></td>
</tr>
<tr>
<td>BIOCHEM 507 &amp; BIOCHEM 508</td>
<td>General Biochemistry I and General Biochemistry II</td>
<td></td>
</tr>
<tr>
<td>BMOLCHEM 503</td>
<td>Human Biochemistry</td>
<td></td>
</tr>
<tr>
<td>BMOLCHEM 704</td>
<td>Comprehensive Human Biochemistry</td>
<td></td>
</tr>
<tr>
<td>D. Advanced Biochemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. AN SCI/OBS&amp;GYN/ZOOLOGY 954</td>
<td>Seminar in Endocrinology-Reproductive Physiology</td>
<td></td>
</tr>
<tr>
<td>F. Technical Writing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Advanced Statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Advanced Endocrinology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Advanced Reproduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Advanced Topic Course. Select one of the following: Gamete and Embryo Biology Reproductive Patterns Selected Topics in Endocrinology-Reproductive Physiology Pregnancy, Parturition, and Lactation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

**Meat Science & Muscle Biology Track**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN SCI/DY SCI/GENETICS 951</td>
<td>Seminar in Animal Breeding</td>
<td></td>
</tr>
<tr>
<td>GENETICS 466</td>
<td>Principles of Genetics</td>
<td></td>
</tr>
<tr>
<td>STAT/F&amp;W ECOL/HORT 571 &amp; STAT/F&amp;W ECOL/HORT 572</td>
<td>Statistical Methods for Bioscience I and Statistical Methods for Bioscience II</td>
<td></td>
</tr>
<tr>
<td>AN SCI/GENETICS 610</td>
<td>Quantitative Genetics</td>
<td></td>
</tr>
<tr>
<td>AN SCI 875</td>
<td>Special Topics (Linear Models for Quantitative Genetics &amp; Molecular Genetics for Animal Breeding)</td>
<td></td>
</tr>
</tbody>
</table>

1 These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.
AN SCI/Food Sci 305 Introduction to Meat Science and Technology
AN SCI 508 Poultry Products Technology
AN SCI/Food Sci 515 Commercial Meat Processing
AN SCI/Food Sci 710 Chemistry of the Food Lipids
BIOCHEM 501 Introduction to Biochemistry
BIOCHEM 507 General Biochemistry I
BIOCHEM 508 General Biochemistry II
BIOCHEM/Nutr Sci 510 Biochemical Principles of Human and Animal Nutrition
BIOCHEM 550 Topics in Medical Biochemistry
BIOCHEM 601 Protein and Enzyme Structure and Function
BIOCHEM/Genetics/Md Genet 620 Eukaryotic Molecular Biology
BIOCHEM 624 Mechanisms of Enzyme Action
BIOCHEM/Phmcol-M/Zool 630 Cellular Signal Transduction
BIOCHEM 636 Macromolecular Crystallography and Dynamics
BIOCHEM 660 Methods in Biochemistry
BIOCHEM 711 Sequence Analysis
BMOLCHEM/Biochem 710 Exploring Biochemical Function of Macromolecules
Chem 565 Biophysical Chemistry
Chem 621 Instrumental Analysis
Food Sci 410 Food Chemistry
Food Sci 412 Food Analysis
Food Sci 432 Principles of Food Preservation
Food Sci 440 Principles of Food Engineering
Food Sci 464 Statistics for Food Industry Quality Control
Food Sci 512 Principles of Food Chemistry-Lab
Food Sci 514 Integrated Food Functionality
Food Sci 532 Integrated Food Manufacturing
Food Sci/Bse 542 Food Engineering Operations
Food Sci 550 Fermented Foods and Beverages
Food Sci 600 Professional Practice in Food Science
Food Sci 610 Food Proteins
Food Sci/Bse 642 Food and Pharmaceutical Separations
Food Sci/Microbio 650 Advanced Microbiology of Foodborne Pathogens
Food Sci 718 Colloid Chemistry of Foods
Microbio 527 Advanced Laboratory Techniques in Microbiology
Microbio/M M & I/Path-Bio 528 Immunology
Microbio/Genetics 607 Advanced Microbial Genetics
Microbio/Food Sci 650 Advanced Microbiology of Foodborne Pathogens
Path-Bio/Hort 500 Molecular Biology Techniques
Stat/F&W Ecol/Hort 571 Statistical Methods for Bioscience I
Stat/F&W Ecol/Hort 572 Statistical Methods for Bioscience II
Zool 430 Comparative Anatomy of Vertebrates
Zool 470 Introduction to Animal Development
Zool 570 Cell Biology
Zool 611 Comparative and Evolutionary Physiology
Zool 612 Comparative Physiology Laboratory

1 These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.
2 Only one course from this group can be counted towards the credit load required in this section.
3 Required of Ph.D. candidates.
4 Required if an equivalent statistics course was not taken previously.

POLICIES

GRADUATE SCHOOL POLICIES
The Graduate School’s Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES
GRADUATE PROGRAM HANDBOOK
The Graduate Program Handbook (http://www.ansci.wisc.edu/docs/graduate/Animal%20Sciences%20Grad%20Handbook.docx) is the repository for all of the program’s policies and requirements.

Prior Coursework

Graduate Work from Other Institutions
For well-prepared advanced students, the program may accept prior graduate coursework from other institutions toward the minimum graduate degree credit and minimum graduate coursework (50%) requirement. The minimum graduate residence credit requirement can be satisfied only with courses taken as a graduate student at UW–Madison.
**UW–Madison Undergraduate**

For well-prepared advanced students, the program may decide to accept up to 7 credits numbered 300 or above completed at UW–Madison toward fulfillment of minimum degree and minor credit requirements. This work would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above.

**UW–Madison University Special**

The program may decide to accept up to 15 University Special student credits as fulfillment of the minimum graduate residence, graduate degree, or minor credit requirements on occasion as an exception (on a case-by-case basis).

UW–Madison coursework taken as a University Special student would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above.

**Probation**

The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

**Advisor / Committee**

Every graduate student is required to have an advisor. To ensure that students are making satisfactory progress toward a degree, the Graduate School expects them to meet with their advisor on a yearly basis.

Your committee members advise and evaluate satisfactory progress, administer your final oral examination, evaluate your thesis, and sign your degree warrant. Your advisor chairs the committee. Ph.D. thesis committees must have at least five members representing more than one graduate program. Your committee must include three faculty members from the animal sciences department, and no more than four, and at least one faculty member outside the department at arm’s length to the project.

Ph.D. thesis committees must have at least five members representing more than one graduate program. Your committee must include three faculty members from the animal sciences department, and no more than four, and at least one faculty member outside the department at arm’s length to the project.

**Credits per Term Allowed**

15 credits

**Time Constraints**

Doctoral degree students who have been absent for ten or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.

A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within five years after passing the preliminary examination may by require to take another preliminary examination and to be admitted to candidacy a second time.

**Other**

RAs, the most common appointment in this department, are hired for 12 months with compensation set on a university-wide basis. The department has a few TAs who assist in instruction, preparing materials, directing labs, grading lab exercises and exams, etc. Special fellowships and scholarships are available for outstanding students. Application instructions may be obtained from the Graduate School website. A graduate student may be employed to assist professors not directly associated with their thesis.

**Professional Development**

**Graduate School Resources**

Take advantage of the Graduate School’s professional development resources (https://grad.wisc.edu/pd) to build skills, thrive academically, and launch your career.

**Program Resources**

The Animal Sciences Graduate programs encourage students to develop Individual Development Plans (https://grad.wisc.edu/pd/idp) in collaboration with their major advisor to facilitate professional development. Besides the extensive opportunities offered across the campus at large, students in the animal sciences program also benefit from activities and programs provided by the Animal Science Graduate Student Association, a student-led organization for graduate students at UW–Madison who are interested in animal and dairy science.

**Learning Outcomes**

1. Articulates research problems, potentials, and limits with respect to theory, knowledge, or practice within the field of study.
2. Formulates ideas, concepts, designs, and/or techniques beyond the current boundaries of knowledge within the field of study.
3. Creates research, scholarship, or performance that makes a substantive contribution.
4. Demonstrates breadth within their learning experiences.
5. Advances contributions of the field of study to society.
6. Communicates complex ideas in a clear and understandable manner.
7. Fosters ethical and professional conduct.

**People**

**Faculty:** Professors Crenshaw (chair), Albrecht, Claus, Khatib, Kirkpatrick, Parish, Reed, Richards, Rosa, Schaefer; Associate Professor Sindelar; Assistant Professor Shanmuganayagam