

Graduate Program in Animal Breeding and Genetics

General Statement

Graduate study in Animal Breeding and Genetics can be pursued in a variety of areas including, but not limited to, theoretical quantitative and statistical genetics, molecular genetics, bioinformatics and functional genomics. Given the diversity of areas of study, there is no single program of coursework specified for students in this field. Faculty from both the Departments of Animal Sciences and Dairy Science are members of the Animal Breeding and Genetics program, and all are listed subsequently. Requirements given below for admission and completion of a graduate degree in Animal Breeding and Genetics pertain to students pursuing a degree in the Department of Animal Sciences.

Faculty in the Departments of Animal Sciences or Dairy Science participating in Animal Breeding and Genetics

J. James Bitgood, Professor, Department of Animal Sciences. Animal cytogenetics and gene mapping in the chicken. Gene mapping using chromosome rearrangement break-points as markers for physical mapping, single gene mutations, molecular markers, and chromosome rearrangements for classical mapping and in an attempt to integrate the classical, physical and molecular genetic map of the chicken. Characterization of single gene mutations and quantitative traits. bitgood@calshp.cals.wisc.edu

Daniel Gianola, Professor, Department of Animal Sciences, Department of Biostatistics and Medical Informatics, Department of Dairy Science. Statistical problems in quantitative genetics and animal breeding; Bayesian approaches for inference about parameters of linear and nonlinear models (e.g., for growth and lactation curves), censored (e.g., productive lifespan) and discrete (e.g., fertility and viability) distributions; Markov chain Monte Carlo methods. International animal breeding and biometry. gianola@calshp.cals.wisc.edu

Brian Kirkpatrick, Professor, Department of Animal Sciences, Department of Dairy Science. Mapping genes contributing to variation in prolificacy and other economically important traits in cattle, swine and mice as a model organism. kirkpat@calshp.cals.wisc.edu

Jack Rutledge, Professor, Departments of Animal Sciences and Genetics

Applications of gamete and early embryo biology to cattle production systems, both domestically and internationally. Breed and species preservation; using a common species as surrogate mothers for an endangered species. rutledge@calshp.cals.wisc.edu

George Shook, Professor, Department of Dairy Science

Genetic improvement of disease resistance in dairy cattle. Genetic relationships of disease traits with other economically important traits and relative economic importance of disease traits in selection indexes. shook@calshp.cals.wisc.edu

David L. Thomas, Professor, Department of Animal Sciences

Genetic improvement of production efficiency of sheep, with special emphasis on improvement of litter size. Comparison of Finnsheep and Romanov breeds under an accelerated lambing program and introgression of the FecB allele for high ovulation rate from the Booroola Merino breed into the Rambouillet breed. Evaluation of European dairy sheep breeds under Wisconsin production conditions. dlthomas@facstaff.wisc.edu

Kent Weigel, Research Scientist

Analysis of data and development of statistical procedures for international genetic comparisons of dairy cattle, factors influencing national genetic evaluations, efficiency of progeny testing programs, assessment of genotype by environment interaction effects on an international level, effects of herd management factors on validity of field data, non-production traits, and national and international outreach programs in dairy cattle genetics. weigel@calshp.cals.wisc.edu

Application to the Graduate School

Admission Requirements

As you apply to the UW-Madison, you need to be aware of two different sets of requirements: (1) Graduate School minimum admission requirements, and (2) department admission requirements.

- (1) The Graduate School sets the minimum admission requirements for all prospective graduate students. The minimum admission requirements are:

A bachelor's degree from an approved (accredited) institution

A minimum undergraduate grade-point average (GPA) of 3.00 (on a 4.0 scale) on the equivalent of the last 60 semester hours (approximately two years of work).

Every applicant whose native language is not English, or whose undergraduate instruction was not in English, must provide official scores from the Test of English as a Foreign Language (TOEFL) or the Michigan English Language Assessment Battery (MELAB). An admitted applicant whose TOEFL (paper-based) test score is below 580; TOEFL computer-based test (CBT) score below 237; or MELAB below 82 must take an English assessment test upon arrival. You must then register for any recommended English as a Second Language (ESL) course(s) in the first semester you are enrolled.

International applicants must have a degree comparable to an approved U.S. bachelor's degree and provide evidence of adequate financial resources for the anticipated duration of their program.

- (2) Departmental admission requirements are in addition to the minimum requirements set by the Graduate School. The Department of Animal Sciences bases its admission on a demonstrated scholastic ability, recent GRE (Graduate Record Exam) scores, letters of recommendation, and the personal statement of reasons for graduate study.

Master of Science Degree Requirements

1. Candidates must complete 16 credits of graduate course work excluding seminar and research and maintain an average grade of B or better.
2. There are no specified course requirements, but the degree program is determined by the student and by the student's advisor, with the approval of a mentoring committee. This committee consists of the student's advisor, and a minimum of two other faculty members; the committee should be selected by the student and advisor by the end of the student's first semester of study.
3. Each student must enroll in Animal Breeding seminar (Animal Science/Genetics 951) each semester.
4. All degree candidates must complete a satisfactory thesis. Instructions on preparing a Masters thesis can be found on the UW graduate school web site at: <http://www.wisc.edu/grad/guide/degrees/mguide.html>.
5. At the completion of the degree program, the candidate will take a final examination administered by the mentoring committee. The examination will be oral, and includes questions relating to the candidate's graduate course program. The candidate will also be expected to defend the thesis.

Doctor of Philosophy Degree Requirements

1. Candidates must complete 32 credits of graduate course work excluding seminar and research and maintain an average grade of B or better.

2. Course program -- Major

There are no specific course requirements, apart from enrollment in Animal Breeding seminar each semester (after passing the preliminary exam, dissertators are not required to enroll in this seminar, but are expected to be active participants). The degree program is determined by the student and by the student's advisor, with the approval of the mentoring committee. The mentoring committee consists of the student's advisor and a minimum of four other faculty members. This committee should be selected by the student and by the advisor by the end of the student's first semester of study towards the Ph.D. degree.

3. Course program -- Minor

The purpose of the minor is to give breadth to a Ph.D. major. Cross-listed courses are permitted if distinct from the major area of study as judged by the major department. There are two kinds of minors: Option A and Option B.

The Option A minor requires:

A minimum of 10 credits in a single department/major field of study. Refer to the individual department for specific requirements; many departments require more than 10 credits.

Approval from the minor department.

The Option B (Distributed) minor requires:

A minimum of 10 credits in one or more departments and can include course work in the major department.

Approval from the major department.

4. Teaching

Each candidate must serve as a Teaching Assistant (TA) for at least one semester-long course during their Ph.D. graduate program. Many candidates choose to serve as a TA for the Animal Science undergraduate animal breeding course (Animal Sciences 360), though other options are available.

5. Preliminary Examination

The preliminary examination consists of an oral examination with questions pertaining to the candidate's graduate course program and area of study. Additionally, the candidate will defend his or her research proposal, which will have been submitted no less than 10 days prior to the preliminary exam date. The mentoring committee administers the preliminary examination.

6. Thesis and Final Examination

The original research conducted by the candidate must be summarized in a thesis. A Final Examination will be given after the completion of the thesis. The thesis must be submitted to the examining committee two weeks before the examination. The candidate is required to present an exit seminar on their dissertation research and to subsequently defend the thesis orally. The thesis must be acceptable from both scientific and literary standpoints. The mentoring committee administers the thesis defense, though both the seminar and defense are open to the public. Graduate school guidelines for preparation of the Ph.D.

dissertations can be found on the web at:
<http://www.wisc.edu/grad/gs/degrees/pguide.html>.

Example PhD course schedule -- Molecular genetics track

Timetable	Course number	Title
Fall, Year 1	Statistics 571 Biochem 501	Statistical Methods for the Biological Sciences or Introduction to Biochemistry
Spring, Year 1	Statistics 572 AHABS 571	Statistical Methods for the Biological Sciences or Molecular Biology Techniques (including laboratory)
Fall, Year 2	AnSci 610 Genetics 613	Quantitative Genetics Prokaryotic Molecular Genetics
Spring, Year 2	AnSci 875 Genetics 614	Gene Mapping Strategies Eukaryotic Molecular Genetics
Fall, Year 3	Vet Sci 875 Genetics 677	Sequence Analysis and Molecular Evolution Advanced Topics in Genetics
Spring, Year 3	Research	

All semesters	DS 900	Seminar in Gene Mapping and Genetic Marker Applications
	AnSci 951	Seminar in Animal Breeding
	DS / AnSci 900	Research under Advisor's Supervision

Example PhD course schedule -- Bioinformatics track

Timetable	Course number	Title
Fall, Year 1	Statistics 571 Biochem 501 Comp Sci 302	Statistical Methods for the Biological Sciences Introduction to Biochemistry Introduction to Programming
Spring, Year 1	Statistics 572 Comp Sci 412 Comp Sci 367	Statistical Methods for the Biological Sciences Introduction to Numerical Methods Introduction to Data Structures

Fall, Year 2	Vet Sci 875 AHABS 711 AHABS 712 Comp Sci 638	Sequence Analysis and Molecular Evolution Sequence Analysis Sequence Analysis Laboratory Undergraduate Topics: Computing (Intro Bioinformatics)
Spring, Year 2	AnSci 875 Stat 333 Comp Sci 838	Gene Mapping Strategies Applied Regression Analysis Topics in Computing (Bioinformatics)
Fall, Year 3	AnSci 610 Stat 309 Stat 824	Quantitative Genetics Introduction to Mathematical Statistics Nonlinear Regression Analysis
Spring, Year 3	Stat 310 Statistics 756 Stat 692 Research	Introduction to Mathematical Statistics II Applied Multivariate Analysis Statistical Genomics

All semesters	DS 900	Seminar in Gene Mapping and Genetic Marker Applications
	AnSci 951	Seminar in Animal Breeding
	DS / AnSci 900	Research under Advisor's Supervision

Example PhD course schedule -- Quantitative and statistical genetics track

Timetable	Course number	Title
Fall, Year 1	Statistics 333 Statistics 309 Genetics 629	Applied Regression Analysis Introduction to Mathematical Statistics Population Genetics
Spring, Year 1	Statistics 824 Statistics 771 Statistics 310	Nonlinear Regression Analysis Statistical Computing Introduction to Mathematical Statistics
Fall, Year 2	AnSci 610 Statistics 609 Statistics 849	Quantitative Genetics Mathematical Statistics Theory and Application of Regression and ANOVA I
Spring, Year 2	Statistics 610 Statistics 775 Statistics 850	Introduction to Statistical Inference Introduction to Bayesian Decision and Control Theory and Application of Regression and ANOVA II

Fall, Year 3	AnSci 875 Statistics 692 DS 875	Mixed Linear Models in Quantitative Genetics Statistical Genomics Estimation and Breeding Value Prediction
Spring, Year 3	AnSci 875 An Sci 875 Statistics 692 Research	Applications of Bayesian Methods in Genetics Gene Mapping Strategies Statistical Genomics

All semesters	AnSci 900	Research under Advisor's Supervision
	AnSci 951	Seminar in Animal Breeding

Abbreviations:

AHABS	Animal Health & Biomedical Sciences	Biochem	Biochemistry
DS	Dairy Science	Genetics	Genetics
AnSci	Animal Sciences	Statistics	Statistics
Comp Sci	Computer Sciences		