

AN SC 485 ANIMAL GENETICS AND BREEDING

*Department of Agricultural, Food and Nutritional Science
Faculty of Agricultural, Life and Environmental Sciences
University of Alberta*

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- Teaching assistant:** TBD
- Office hours:** By appointment—send an e-mail to set up a time.
- Lecture/Seminar:** Remote delivery until further notice: Mon, Wed, Fri, 13:00 to 13:50; Zoom link on eClass; in-person lectures and exams will be in room CAB 365.
- Lab:** Remote delivery until further notice: Fri, 14:00 to 15:50; Zoom link on eClass; in-person labs will be in room CL 1-30.
- Lab time:** The lab period is intended to serve as a scheduled time for students to work on assignments or laboratory exercises and to have access to the instructors or teaching assistant for assistance. The instructors/teaching assistant and students will not meet for all lab periods (see schedule below).
- Format:** Lectures and labs will be conducted by Zoom until in-person classes are permitted. Lectures and labs will be recorded, and the recordings will be shared on eClass. Recordings of this course will be used for the purpose of asynchronous learning. Students have the right to not participate in the recording and are advised to turn off their cameras and audio prior to recording; they can still participate through text-based chat. It is recommended that students remove all identifiable and personal belongings from the space in which they will be participating. Recordings will be made available until April 30, 2022. Due to the potential for technical issues when recording, the availability of recordings cannot be guaranteed, and it is possible that some lectures or labs will not have recordings available. Lecture slides will be provided for all lectures.
- Prerequisites:** AN SC 384. Students seeking a prerequisite waiver must contact the ALES Undergraduate Student Services Office (USSO).
- Calendar description:** *Application of genetic/genomic principles and methods to the improvement of livestock and poultry.*
- Course materials:** Lecture materials and associated readings will be made available through the AN SC 485 eClass site. There is no required textbook for the course, however *Understanding Animal Breeding*, 2nd edition by Richard Bourdon is recommended. Additional recommended references or readings will be

added to eClass throughout the term.

Learning outcomes

- Students will be able to define and explain genetics and genomics terms and concepts.
- Students will be able to describe and interpret recent papers related to the discovery or application of gene function information in animals.
- Students will be able to apply their knowledge of gene structure and function in order to predict the impacts of known and hypothetical DNA changes on phenotype.
- Students will be able to build upon genomics and genetics concepts, tools, and knowledge in order to devise strategies for modifying animal traits.
- Students will be able to describe the principles of genetic evaluation and will be able to predict the genetic merit of breeding stocks using pedigree/phenotype/DNA marker data for quantitative traits.
- Students will be able to make genetic selection decisions based on single/multiple traits and will be able to predict and monitor genetic improvement rates.
- Students will be able to apply knowledge of non-additive genetic influence on performance traits in order to develop strategies to maximize animal performance.

Course overview

Students will learn about key concepts of genetics and genomics, particularly as they pertain to animal breeding and genome modification. Lectures will explore a variety of specific topics and will cover well-established as well as emerging technologies and techniques. Recent papers will be discussed to illustrate how knowledge of gene function can be acquired or applied. Assignments and labs will provide students with the opportunity to explore and apply concepts to real-world datasets. Students will be evaluated through assignments, a midterm exam, and a final exam.

Seminar and lab schedule (subject to change)

Date	Day	Lecture (M, W, F)	Lab (Friday)	Assignment
Jan 5	Wed	Gene structure, gene expression (Dr. Stothard)	No lab	
Jan 7	Fri	Gene structure, gene expression (Dr. Stothard)		
Jan 10	Mon	Gene structure, gene expression (Dr. Stothard)	No lab	
Jan 12	Wed	Genome sequencing, genotyping (Dr. Stothard)		
Jan 14	Fri	Genome sequencing, genotyping (Dr. Stothard)	No lab	
Jan 17	Mon	Genome sequencing, genotyping (Dr. Stothard)		
Jan 19	Wed	Genome sequencing, genotyping (Dr. Stothard)	No lab	Assignment 1 due
Jan 21	Fri	Genome modification (Dr. Stothard)		
Jan 24	Mon	Genome modification (Dr. Stothard)	No lab	
Jan 26	Wed	Genome modification (Dr. Stothard)		
Jan 28	Fri	Genome modification (Dr. Stothard)	No lab	
Jan 31	Mon	Recent research papers (Dr. Stothard)		
Feb 2	Wed	Recent research papers (Dr. Stothard)	No lab	Assignment 2 due
Feb 4	Fri	Recent research papers (Dr. Stothard)		
Feb 7	Mon	Recent research papers (Dr. Stothard)	RStudio introduction	
Feb 9	Wed	Recent research papers (Dr. Stothard)		
Feb 11	Fri	Recent research papers (Dr. Stothard)	No lab	Assignment 3 due
Feb 14	Mon	Recent research papers (Dr. Stothard)		
Feb 16	Wed	Midterm	No lab	
Feb 18	Fri	Partitioning of phenotype values and variation (Dr. Li)		

Feb 21	Mon	Family Day, no lecture		
Feb 23	Wed	Winter Term Reading Week, no lecture		
Feb 25	Fri	Winter Term Reading Week, no lecture	No lab	
Feb 28	Mon	Partitioning of phenotype values and variation (Dr. Li)		
Mar 2	Wed	Partitioning of phenotype values and variation (Dr. Li)		
Mar 4	Fri	Genetic evaluation within herd (Dr. Li)	No lab	
Mar 7	Mon	Genetic evaluation within herd (Dr. Li)		
Mar 9	Wed	Genetic relationships among animals - review (Dr. Li)		
Mar 11	Fri	Best linear unbiased prediction (BLUP) (Dr. Li)	R introduction	
Mar 14	Mon	Best linear unbiased prediction (BLUP) (Dr. Li)		
Mar 16	Wed	Best linear unbiased prediction (BLUP) (Dr. Li)		
Mar 18	Fri	Best linear unbiased prediction (BLUP) (Dr. Li)	R introduction	Assignment 4 due
Mar 21	Mon	Introduction to genomic prediction (Dr. Li)		
Mar 23	Wed	Introduction to genomic prediction (Dr. Li)	Lab - Work on assignment 5	
Mar 25	Fri	Introduction to genomic prediction (Dr. Li)		
Mar 28	Mon	Selection for more than one trait (Dr. Li)		
Mar 30	Wed	Selection for more than one trait (Dr. Li)	Lab - Work on assignment 5	
Apr 1	Fri	Predicting genetic improvement rate (Dr. Li)		
Apr 4	Mon	Predicting genetic improvement rate (Dr. Li)		
Apr 6	Wed	Strategies to maximize animal performance (Dr. Li)	Lab - Work on assignment 5	
Apr 8	Fri	Strategies to maximize animal performance (Dr. Li)		Assignment 5 due
Apr 15	Fri	-		Assignment 6 due

Course grading

Type	Date	Marks	Total
Assignments (6)	Jan 19	5	35
	Jan 31	5	
	Feb 11	5	
	Mar 18	5	
	Apr 8	10	
	Apr 15	5	
Midterm exam (1 hour)	Feb 16, 1:00 pm	25	25
Final exam (2 hours)	Apr 22, 9:00 am	40	40
Total			100

Assignments

- Unless otherwise specified, assignments are due **at 11 pm on the specified date**.
- All assignments must be uploaded to eClass. If there is a problem with eClass, send the assignment to the instructor by email.
- Late assignments will be downgraded 25% per day (or portion thereof).
- Posting content from an assignment to obtain answers from others is a violation of the student code of conduct--it is cheating and it is mishandling of materials.
- Using assignment answers that have been posted online is cheating.
- Inadequate paraphrasing is plagiarism. Plagiarism is in violation of the Code of Student Behaviour.

Exams

- Exams will be completed in-person in the lecture room. In-person exams will be closed book exams.
- For in-person exams, mobile phones or other communication devices must be turned off and placed in a bag or pocket during examinations.
- For in-person exams, approved non-programmable calculators are permitted (calculators may be inspected prior to use in the exam).
- The final exam will focus on material taught after the midterm exam, i.e. the final exam is not cumulative. For in-person final exam, a complete list of formulas from the lectures will be provided.
- If in-person exams are not allowed due to the Covid, open book exams will be administered with a different set of questions.

Missed midterm exam

A mark of zero will normally be given if a student misses the midterm examination. Whenever possible, students are expected to notify the instructor prior to missing the exam. In some circumstances, where there is an acceptable reason for missing the midterm, the value of the midterm exam will be moved to the final exam.

Missed final exam

The University policy on deferred exams can be found in Section 23.3.2 of the University Calendar. It includes specific instructions on how to obtain a deferral. The Instructors can neither give permission to a student to miss the final exam nor grant a request for a deferred final exam. Students are encouraged to check exam schedules prior to making travel or event plans. The decision to grant a deferred final exam can only be granted by their own Faculty (e.g. ALES students go to 206 Agriculture/Forestry Centre to obtain an exam deferral, Science students go to 1-001 CCIS).

Final grade assessment is the responsibility of the instructors. Letter grades will be assigned only to the final distribution of aggregate raw scores. There will be no predetermined “curving” to assign final grades but instead cut-offs for different grades will be based on real breakpoints in the overall distribution of raw marks within a class for the current academic year.

Access to representative evaluative material

Students will be given access to representative evaluative materials through eClass.

Academic integrity

“The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.governance.ualberta.ca) and avoid any behavior which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.” (GFC 2003)

Code of student behavior

All students at the University of Alberta are subject to the Code of Student Behaviour, as outlined at: <https://www.ualberta.ca/governance/resources/policies-standards-and-codes-of-conduct/code-of-student-behaviour>. Please familiarize yourself with it and ensure that you do not participate in any

inappropriate behavior as defined by the Code. Key components of the code include the following statements:

30.3.2(1) No Student shall submit the words, ideas, images or data of another person as the Student's own in any academic writing, essay, thesis, project, assignment, presentation or poster in a course or program of study.

30.3.2(2) c. No Student shall represent another's substantial editorial or compositional assistance on an assignment as the Student's own work.

Additional information

Policy about course outlines can be found in Course Requirements, Evaluation Procedures and Grading of the University Calendar.

Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content author(s).