



# **MBG\*4030 Animal Breeding Methods and Applications**

Winter 2023

Section(s): C01

Department of Animal Biosciences

Credit Weight: 0.50

Version 1.00 - January 17, 2023

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## **1 Course Details**

### **1.1 Calendar Description**

Theoretical and scientific aspects of practical animal breeding programs which lead to genetic improvement of efficiency and profitability of animal production will be presented along with applications to livestock and poultry species. This course integrates quantitative genetics with concepts of statistics, economics, biology and biotechnology and expands into development of practical breeding plans.

**Pre-Requisites:** MBG\*3060

### **1.2 Course Description**

This is a fourth-year undergraduate course for the study of methodology in animal breeding used for genetic improvement of livestock. This course covers the practical application of methods for genetic assessment of animals and breeding programs; the development of appropriate linear models for analysis of data; understanding genetic parameters; and the measurement of genetic change in the population. Genetic theory is reviewed as needed. The course involves statistical methods and computing (using R) to learn data analysis techniques in animal breeding.

A pre-requisite of STAT\*2040 is strongly encouraged for success in this course.

## 1.3 Timetable

Lectures M/W/F 8:30 AM - 9:20 AM 1/9/2023 - 4/25/2023, ANNU 102

Lab Sec. 0101 T 8:30 AM - 10:20 AM 1/9/2023 - 4/25/2023, ANNU 102

Lab Sec. 0102 M 2:30 PM - 4:20 PM 1/9/2023 - 4/25/2023, ANNU 102

## 1.4 Final Exam

Thur 2023/04/17 02:30PM - 4:30PM

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

# 2 Instructional Support

## 2.1 Instructional Support Team

<b>Instructor:</b>	Christine Baes
<b>Email:</b>	cbaes@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x53363
<b>Office:</b>	ANNU 124

## 2.2 Teaching Assistants

<b>Teaching Assistant (GTA):</b>	Colin Lynch
<b>Email:</b>	clynch@uoguelph.ca
<b>Office Hours:</b>	TBA

## 2.3 Communicating with your Instructor

During the course, your instructor will interact with you on various course matters on the course website using the following ways of communication:

- **Announcements:** The instructor will use **Announcements** on the Course Home page to provide you with course reminders and updates. Please check this section frequently for course updates from your instructor.
- **Ask Your Instructor Discussion:** Use this discussion forum to ask questions of your instructor about content or course-related issues with which you are unfamiliar. If you encounter difficulties, the instructor is here to help you. Please post general course-related questions to the discussion forum so that all students have an opportunity to

review the response. To access this discussion forum, select **Discussions** from the **Tools** dropdown menu.

- **Email:** If you have a conflict that prevents you from completing course requirements, or have a question concerning a personal matter, you can send your instructor a private message by email. Please include "MBG\*4030" (no space) in subject line
- **Video Call:** If you have a complex question you would like to discuss with your instructor, you may book a video meeting on Teams (or alternate platform being used by your instructor). Video meetings depend on the availability and are booked on a first come first served basis.

## 2.4 Netiquette Expectations

### Online Behaviour

**Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include:**

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references
- Buying or selling term papers or assignments
- Posting or selling course materials to course notes websites
- Having someone else complete your quiz or completing a quiz for/with another student
- Stating false claims about lost quiz answers or other assignment submissions

- Threatening or harassing a student or instructor online
  - Discriminating against fellow students, instructors and/or TAs
  - Using the course website to promote profit-driven products or services
  - Attempting to compromise the security or functionality of the learning management system
  - Sharing your user name and password
  - Recording lectures without the permission of the instructor
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## **3 Learning Resources**

### **3.1 Recommended Resources**

#### **Recommended Texts (Textbook)**

- Linear Models for the Prediction of Animal Breeding Values; Author: Mrode, Raphael
- Understanding Animal Breeding; Author: Bourdon, Richard M.

### **3.2 Communication**

All communication outside of class will be through CourseLink and Teams.

- News: important messages regarding the course will be posted in the News section on CourseLink. Please check this regularly.
- Discussion: Please use the Discussion option on CourseLink to ask question and

discuss course content and assignments with the entire class. The instructor and GTA will monitor the online Discussion and answer questions there.

- Any emailed questions related to the course content will be copied to the CourseLink Discussion and answered there for the benefit of all students.
- Email: Please email the instructor or GTA for personal communications, such as scheduling an appointment, missed exam or assignment, or other personal concerns. Please include “MBG4030” (no space) in subject line

## 3.2 Other Resources

Notes, lecture slides, assignments, data sets, R scripts, etc. will be posted on CourseLink. Most of the assignments will require the use of free R software (see Links at CourseLink for download). Please see the Links section for additional materials. Students are advised to take their own notes during lectures.

## 3.2 Course Technology and Technical Support

### System and Software Requirements

This course will use a variety of technologies including;

- CourseLink (main classroom)
- Teams (via Office 365)
- Zoom

To help ensure you have the best learning experience possible, please review the list of system and software requirements.

<https://opened.uoguelph.ca/student-resources/system-and-software-requirements>

## **CourseLink System Requirements**

You are responsible for ensuring that your computer system meets the necessary system requirements. Use the browser check tool to ensure your browser settings are compatible and up to date. (Results will be displayed in a new browser window).

<http://spaces.uoguelph.ca/ed/system-requirements/>  
<https://courselink.uoguelph.ca/d2l/systemCheck>

## **Course Technologies**

### **CourseLink**

This course is being offered using CourseLink (powered by D2L's Brightspace), the University of Guelph's online learning management system (LMS). By using this service, you agree to comply with the University of Guelph's Access and Privacy Guidelines. Please visit the D2L website to review the Brightspace privacy statement and Brightspace Learning Environment web accessibility standards.

<http://www.uoguelph.ca/web/privacy/> <https://www.d2l.com/legal/privacy/>  
<https://www.d2l.com/accessibility/standards/>

### **Technical Support**

If you need any assistance with the software tools or the CourseLink website, contact CourseLink Support.

Email: [courselink@uoguelph.ca](mailto:courselink@uoguelph.ca)

Tel: 519-824-4120 ext. 56939 Toll-Free (CAN/USA): 1-866-275-1478

**Support Hours (Eastern Time):**

Monday thru Friday: 8:30 am–8:30 pm

Saturday: 10:00 am–4:00 pm

Sunday: 12:00 pm–6:00 pm

**Teams (via Office 365)**

Office 365 Teams is a collaboration service that provides shared conversation spaces to help teams coordinate and communicate information. This course will use Teams for labs and lectures. It is recommended that you use the desktop version of Teams. As a student you are responsible for learning how to use Teams and its features.

For Teams Support visit the CCS website for more information.

<https://www.uoguelph.ca/ccs/services/office365/teams>

**3.2 Technical Skills**

As part of your learning experience, you are expected to use a variety of technologies for assignments, lectures, teamwork, and meetings. In order to be successful in this course you will need to have the following technical skills:

- Manage files and folders on your computer (e.g., save, name, copy, backup, rename, delete, and check properties);
- Install software, security, and virus protection;

- Use office applications (e.g., Word, PowerPoint, Excel, or similar) to create documents;
- Be comfortable uploading and downloading saved files;
- Communicate using email (e.g., create, receive, reply, print, send, download, and open attachments);
- Navigate the CourseLink learning environment and use the essential tools, such as Dropbox, Quizzes, Discussions, and Grades (the instructions for this are given in your course);
- Access, navigate, and search the Internet using a web browser (e.g., Firefox, Internet Explorer); and
- Perform online research using various search engines (e.g., Google) and library databases.

## 3.2 Library Access

As a student, you have access to the University of Guelph's library collection, including both physical and electronic materials. For information on checking out or couriering physical library items, accessing electronic journals and returning items to the library, visit the library's website.

If you are studying off campus and would like to access the library's electronic resources, use the Off Campus Login and login using your Single Sign On credentials or using your last name and library barcode.

<https://www.lib.uoguelph.ca/>

<https://www.lib.uoguelph.ca/campus-login>

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# 4 Learning Outcomes

## 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Integrate quantitative genetics with statistics and biology to evaluate the breeding merit



- of animals.
2. Perform and understand simple data analyses for predicting breeding values of livestock.
  3. Appreciate differences among livestock species and their production systems.
  4. Integrate knowledge of genetic improvement techniques and evaluate how those techniques are applied to breeding programs in different species.
  5. Discuss the relative merits of methods used to predict breeding values and select for multiple objectives.
  6. Optimize selection and mating decisions for maximum genetic response in practical breeding schemes.
  7. Assess the impact of new technologies and methods in reproduction and molecular genetics on breeding programs
  8. Accurately and effectively record and communicate scientific analyses in graphic and written form.
  9. Have a command of basic terminology common in applied livestock genetics / genomics.
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## 5 Teaching and Learning Activities

### 5.1 Lecture

**Topics:**

The following is an approximate schedule of lecture topics. Guest lecturers will be announced.

Lecture	Weekday	Date	Time	Topic
1	Monday	Jan. 09	8:30 a.m.	Genetics Overview
2	Wednesday	Jan. 11	8:30 a.m.	Matrix Algebra
3	Friday	Jan. 13	8:30 a.m.	Linear Models
4	Monday	Jan.	8:30	ANOVA

<b>Lecture</b>	<b>Weekday</b>	<b>Date</b>	<b>Time</b>	<b>Topic</b>
		16	a.m.	
5	Wednesday	Jan. 18	8:30 a.m.	Solving Mixed Models
6	Friday	Jan. 20	8:30 a.m.	Pedigrees and Relationships
7	Monday	Jan. 23	8:30 a.m.	Animal Models
8	Wednesday	Jan. 25	8:30 a.m.	Animal Models with BLUP
9	Friday	Jan. 27	8:30 a.m.	Variance Estimation
10	Monday	Jan. 30	8:30 a.m.	Sire Repeated Models
11	Wednesday	Feb. 01	8:30 a.m.	Maternal Models
12	Friday	Feb. 03	8:30 a.m.	Multiple Traits (1)
13	Monday	Feb. 06	8:30 a.m.	Multiple Traits (2)
14	Wednesday	Feb. 08	8:30 a.m.	Genomics

Lecture	Weekday	Date	Time	Topic
15	Friday	Feb. 10	8:30 a.m.	Genomics
16	Monday	Feb. 13	8:30 a.m.	Genomics
17	Wednesday	Feb. 15	8:30 a.m.	<b>Midterm review</b>
18	Friday	Feb. 17	8:30 a.m.	<b>Mid-term (in-class)</b>
19	Monday	Feb. 27	8:30 a.m.	Research Presentations (1)
20	Wednesday	Mar. 01	8:30 a.m.	Research Presentations (2)
21	Friday	Mar. 03	8:30 a.m.	Research Presentations (3)
22	Monday	Mar. 06	8:30 a.m.	Key Equation including Genomic information
23	Wednesday	Mar. 08	8:30 a.m.	Multi-trait selection (1)
24	Friday	Mar. 10	8:30 a.m.	Multi-trait selection (2)

<b>Lecture</b>	<b>Weekday</b>	<b>Date</b>	<b>Time</b>	<b>Topic</b>
25	Monday	Mar. 13	8:30 a.m.	Selection Index
26	Wednesday	Mar. 15	8:30 a.m.	Mating and Heterosis
27	Friday	Mar. 17	8:30 a.m.	Mating and Heterosis (Crossbreds)
28	Monday	Mar. 20	8:30 a.m.	Mating and Heterosis (Crossbreds)
29	Wednesday	Mar. 22	8:30 a.m.	Guest Lecture: Beef
30	Friday	Mar. 24	8:30 a.m.	Guest Lecture: Goat
31	Monday	Mar. 27	8:30 a.m.	Guest Lecture: Data
32	Wednesday	Mar. 29	8:30 a.m.	Guest Lecture: Pig
33	Friday	Mar. 31	8:30 a.m.	Guest Lecture: Turkey
34	Monday	Apr. 3	8:30 a.m.	Guest Lecture: Dairy
35	Friday	Apr. 5	8:30	Summary: Applications of

Lecture	Weekday	Date	Time	Topic
			a.m.	Breeding Methods
36	Monday	Apr. 10	8:30 a.m.	Final Review
	Wednesday	Apr. 17	02:30 p.m.	<b>FINAL EXAM</b>

## 5.2 Lab

**Topics:**

The following is a schedule of lab topics.

Lab	Weekday	Date	Time	Topic
0	Monday / Tuesday	Jan. 9/10	S02: 2:30-4:20 p.m. S01: 8:30-10:30 a.m.	Introduction to R
1	Monday / Tuesday	Jan. 16/17	S02: 2:30-4:20 p.m.	Matrix algebra

Lab	Weekday	Date	Time	Topic
			S01: 8:30- 10:30 a.m	
2	Monday / Tuesday	Jan. 23/24	S02: 2:30- 4:20 p.m.  S01: 8:30- 10:30 a.m	Data Exploration, Linear Models, ANOVA
3	Monday / Tuesday	Jan. 30/31	S02: 2:30- 4:20 p.m.  S01: 8:30- 10:30 a.m	Inbreeding, Relationship matrices
4	Monday / Tuesday	Feb. 6/7	S02: 2:30- 4:20 p.m.  S01: 8:30- 10:30 a.m	Animal Model, BLUP Breeding Values, Mixed Model Equations

Lab	Weekday	Date	Time	Topic
5	Monday / Tuesday	Feb. 13/14	S02: 2:30-4:20 p.m. S01: 8:30-10:30 a.m	Sire Model, Repeated Records Model, Maternal Effects Model
6	Monday / Tuesday	Feb. 27/28	S02: 2:30-4:20 p.m. S01: 8:30-10:30 a.m	Markers / Genomics
7	Monday / Tuesday	Mar. 6/7	S02: 2:30-4:20 p.m. S01: 8:30-10:30 a.m	Key Equation, Selection
8	Monday / Tuesday	Mar. 13/14	S02: 2:30-4:20	Multiple Trait Selection, Aggregate

Lab	Weekday	Date	Time	Topic
			p.m. S01: 8:30- 10:30 a.m	Genotypes, Selection Index
9	Monday / Tuesday	Mar. 20/21	S02: 2:30- 4:20 p.m. S01: 8:30- 10:30 a.m	Heterosis and Crossbreeding
10	Monday / Tuesday	Mar. 27/28	S02: 2:30- 4:20 p.m. S01: 8:30- 10:30 a.m	Heterosis and Crossbreeding Lab Due, Lab Binders Due
-	Monday / Tuesday	Apr. 2/4	S02: 2:30- 4:20 p.m. S01: 8:30- 10:30 a.m	Open Study / Question Period



## 6 Assessments

### 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Course Assignments and Tests	0
Lab Assignment	30
Midterm	20
Lab Binder	20
Final Exam	30
Total	100

### 6.2 Assessment Details

#### Course Assignments and Tests (0%)

Assignment or Test	Due Date	Contribution to Final Mark (%)	Learning Outcomes Assessed
Lab Assignments	Weekly	30	1 - 9
Midterm	February 17th	20	1 - 5
Lab Binder	April 10th	20	1 - 9
Final Exam	April 17th	30	1 - 9

**Lab Assignment (30%)****Date:** Weekly**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8, 9**Midterm (20%)****Date:** Fri, Feb 17, 8:30 AM - 10:20 AM**Learning Outcome:** 1, 2, 3, 4, 5**Lab Binder (20%)****Date:** Mon, Apr 10**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8, 9**Final Exam (30%)****Date:** Mon, Apr 17, 2:30 PM - 4:30 PM**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8, 9

## 6.3 Additional Notes:

**Lab Assignments:**

- Lab assignments contribute 30% to the final grade.
- Assignments will be posted on CourseLink and discussed during labs. I expect students to make full use of lab time to learn methods and techniques needed in the assignments.
- You will have one week to work on the assignments and hand them in during the next lab.
- **Late assignments will be penalized with a grade reduction of 50% per day.**
- Marked assignments will be returned during labs the following week. Solutions and Grades will be posted on CourseLink.
- There will be 10 assignments. It is in your best interest to do them all, as they reinforce concepts introduced in class and are good practice for exams.
- If you miss more than one assignment for a valid reason your mark will be re-weighted based on those that were handed in. Otherwise, missed assignments will receive a grade of 0.

**Midterm:**

- The midterm examination will contribute 20% to the final grade.

- The midterm examination will take place in class on Friday, February 17th.
- You will receive one page with formulas you might need for the midterm.
- If you miss the midterm for a valid reason, your final exam will be worth 50% of your final grade.

#### Lab Binder:

- The lab binder will contribute 20% to the final grade.
- The lab binder is a collection of all lab exercises, including assignments, R scripts, answers, and summary / discussion pages for each lab.
- The lab binder is due on April 10th
- Grading of lab binders will be as follows:
  - Contents page (5 points)
  - Completeness / Uniformity (5 points)
  - Clarity / Neatness (5 points)
  - R scripts (10 points)
  - Discussions (20 points)
  - Overall impression (5 points)

#### Final Exam:

- The final exam is worth 30% of your final grade.
- Exams will cover both lab and lecture material.
- You will receive one page with formulas you might need for the midterm.
- You can use your own calculator.

**Final examination date and time:** Thursday, April 17th from 02:30pm - 04:30pm.

## 7 Course Statements

### 7.1 Grading Policies

- You will have one week to work on the assignments and hand them in during the next lab.
- **Late assignments will be penalized by a grade reduction of 50% per day.**
- Marked assignments will be returned during labs the following week. Solutions and Grades will be posted on CourseLink.
- There will be 10 assignments. It is in your best interest to do them all, as they reinforce concepts introduced in class and are good practice for exams.
- If you miss more than one assignment for a valid reason your mark will be re-weighted based on those that were handed in. Otherwise, missed assignments will receive a grade of 0.

### 7.2 Course Policy on Group Work

While you are encouraged to discuss the assignment problems with fellow students, each student must hand in an individual solution that is the result of his/her own efforts.

### 7.3 Course Policy regarding use of electronic devices and recording of Lectures

Electronic recording of lectures or labs is not permitted.

## 8 University Statements

## 8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

## 8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

## 8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

## 8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared

responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website  
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website  
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student,

or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

## 8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

## 8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campusess/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campusess/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

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