ANSC*6390 - QTL and Genetic Markers

Winter 2025 Course Outline
Section: 01
Credits: 0.50

Land Acknowledgement: Guelph

The University of Guelph resides on the ancestral lands of the Attawandaron people and the treaty lands and territory of the Mississaugas of the Credit. We recognize the significance of the Dish with One Spoon Covenant to this land and offer respect to our Anishinaabe, Haudenosaunee and Métis neighbours. Today, this gathering place is home to many First Nations, Inuit, and Métis peoples and acknowledging them reminds us of our important connection to this land where we work and learn.

Calendar Description

Advanced training in QTL mapping and selection assisted by genetic markers.
Department(s): Department of Animal Biosciences

Course Description

This graduate course will teach statistical models and methods used in the detection of Quantitative Trait Loci (QTL) and selection assisted by genetic markers in livestock. By the end of the course, a student will be able to use quantitative genetics, genetic marker information, and statistics to map QTL and describe factors that affect QTL mapping and identification of candidate genes and how QTL can be exploited in selection assisted by genetic markers. Concepts of genome wide association analysis and genomic selection will be introduced.

Topics:

Block 1: Review of Mendelian, Population, and Quantitative Genetics. Foundations of linkage mapping.

Block 2: Different designs of linkage mapping experiments.

Block 3: Linkage and linkage disequilibrium (LD) mapping.

Block 4: Bioinformatics tools to hunt for causative mutations.

Block 5: Selection assisted by linked, LD and direct markers, and genomic selection.

Lecture Schedule

WedFri 1pm-2:20pm in ANNU*030 (1/6 to 4/21)

Lectures will be held on Monday and on Wednesday 1pm - 2:20pm in ANNU*030 (1/6 to 4/21)
This course will use a variety of technologies including:

- CourseLink
- Zoom (see comments on Zoom below)

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

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

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

Zoom

This course will use Zoom for delivering lectures ONLY for those who are sick with a transmittable disease, such as Covid 19 and Influenza. Check your system requirements to ensure you will be able to participate if needed.

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

Instructor Information

Flavio Schenkel
Email: schenkel@uoguelph.ca

Additional Support

Office hours: Wednesdays from 2:30-3:30 pm in room ANNU 121.

Learning Resources

Required Resources

All lectures slides and assignments are posted on the course website: Course link (https://courselink.uoguelph.ca/)

Course Resources

Course notes from Dr. Ben Hayes ("Gene detection and marker assisted selection: Putting the theory into practice") and Dr. Lawrence Schaeffer ("ANSC*6390 Quantitative Genetics") will be used during the course (both available in the course's webpage).

Extra pertinent information, such as papers, chapters of books, etc. will be accordingly recommended. Students are advised to take their own notes during lectures.

Campus Resources

If you are concerned about any aspect of your academic program: Make an appointment with a Program Counsellor (https://www.uoguelph.ca/uaic/programcounsellors/) in your degree program. If you are struggling to succeed academically: There are numerous academic resources offered by the Learning Commons (https://www.lib.uoguelph.ca/using-library/spaces/learning-commons/) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills.

Cost of Textbooks and Learning Resources

Textbook / Learning Resource	Required / Recommended	Cost
There are no costs for notes, textbooks and learning resources used in this course.		

Students are advised that prices are often determined by the publisher or bookstore and may be subject to change.

Course Learning Outcomes

1. Integrate quantitative genetics, genetic markers and statistics to detect and map QTL and hunt for candidate genes.
2. Perform and understand data analyses for detecting and mapping QTL in livestock.
3. Appreciate differences among mapping designs and mapping methods.
4. Integrate knowledge of quantitative genetics and mapping techniques and evaluate how the results from these techniques are applied to breeding programs.
5. Discuss the relative merits of methods and designs used for mapping QTL.
6. Optimize QTL detection and mapping to maximize power and genetic variance accounted for the genetic markers.
7. Accurately and effectively communicate scientific analyses in written form.
8. Have a proficient command terminology common in QTL mapping, selection assisted by genetic markers and genomics.

Schedule of Topics and Assignments

Day Date Topic Activities (Due date)
Mon 1/6 Lecture
Wed 1/8 Lecture
Mon 1/13 Lecture Assignment 1: Quantitative genetics and polymorphism information content (1/20)
Wed 1/15 Lecture
Mon 1/20 Lecture Assignment 2: Recombination and mapping functions (1/27)
Wed 1/22 Lecture
Mon 1/27 Lecture Assignment 3: Maximum likelihood estimators (2/3)
Wed 1/29 Lecture
Mon 2/3 Lecture Assignment 4: Single marker-QTL analysis in a F2 design (2/10)
Wed 2/5 Lecture
Mon 2/10 Lecture
Wed 2/12 Mid-term exam In class, closed book exam
Mon 2/17 Winter Break
Wed 2/19 Winter Break
Mon 2/24 Lecture Assignment 5: Interval mapping (3/3)
Wed 2/26 Lecture
Mon 3/3 Lecture Assignment 6: Interval mapping with complex pedigrees (3/10)
Wed 3/5 Lecture
Mon 3/10 Lecture Assignment 7: Linkage disequilibrium mapping (3/17)
Wed 3/12 Lecture
Mon 3/17 Lecture Assignment 8: Haplotyping (3/24)
Wed 3/19 Lecture
Mon 3/24 Lecture Assignment 9: Candidate Gene Association Analysis (3/31)
Wed 3/26 Lecture
Mon 3/31 Lecture
Wed 4/2 Lecture Final exam: Take-home final exam (4/16)

Assessment Breakdown

Description	Weighting (%)	Due Date
Assignments	33%	Several dates
Midterm	33%	2/12
Final	33%	4/16

Assessment Details

Assignment

Assignment 1 **3.78**
Course Learning Outcomes Assessed: 1

Assignment 2 **3.78**
Course Learning Outcomes Assessed: 1

Assignment 3 **3.78**
Course Learning Outcomes Assessed: 1, 2

Assignment 4 **3.78**
Course Learning Outcomes Assessed: 1, 2, 3

Assignment 5 **3.78**
Course Learning Outcomes Assessed: 1, 2, 3, 4, 5

Assignment 6 **3.78**
Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6

Assignment 7 **3.77**
Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6

Assignment 8 **3.77**
Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6, 7

Assignment 9 **3.77**
Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6, 7, 8

Exam

Mid-term exam **33**
Course Learning Outcomes Assessed: 1, 2, 3, 4, 5

Final exam **33**
Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6, 7, 8

Last Day to Drop Course

The final day to drop Winter 2025 courses without academic penalty is the last day of classes: April 04

After this date, a mark will be recorded, whether course work is completed or not (a zero is assigned for missed tests/assignments). This mark will show on the student's transcript and will be calculated into their average.

Course Grading Policies

Submission of Assignments

All assignments (including the take home final exam) must be submitted by 5:30 pm of the due date.

Late Assignment

Late assignments will be penalized as follows:

1 day late – 25% penalty (i.e. discount) applied to the obtained grade

2 days late – 50% penalty applied to the obtained grade

3 days late – 75% penalty applied to the obtained grade

>3 days late – 100% penalty applied to the obtained grade

Course Standard Statements

Course Policies

In person class attendance is mandatory.

Course Technology Requirements

As part of your learning experience, students are expected to use a variety of technologies for assignments, lecture slides, etc. 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, Discussions, and Grades;
- Access, navigate, and search the Internet using a web browser (e.g., Firefox, Internet Explorer); and
- Perform online research using various search engines and library databases.

Standard Statements for Graduate Courses

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 discourages misconduct. 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.

The Academic Misconduct Policy (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/academic-misconduct/) is outlined in the Graduate Calendar.

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.

Use of the SAS Exam Centre requires students to make a booking at least 10 business days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time. For students at the Guelph campus, information can be found on the SAS website. (https://www.uoguelph.ca/sas/)

Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the Academic calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/academic-accommodation-religious-obligations/)

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.

Drop Date

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for Dropping Courses (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/registration/) dropping courses are available in the Graduate Calendar (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/registration/).

Email Communication

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

Health and Wellbeing

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (https://wellness.uoguelph.ca/). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (https://wellness.uoguelph.ca/navigators/) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources. (https://wellness.uoguelph.ca/shine-this-year/) The Student Wellness team are here to help and welcome the opportunity to connect with you.

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).

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.

Resources

The Academic Calendars (http://www.uoguelph.ca/registrar/calendars/?index) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

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. See the Graduate Calendar for information on regulations and procedures for Academic Consideration (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/grounds-academic-consideration/).