ANSC*6210 Selection in Animal Breeding

Course Outline, Winter 2026

Instructor
Colin Lynch (seasonal instructor only for W26)
Animal Biosciences, office #124
clynch@uoguelph.ca

Lectures
Tuesday and Thursday, 2:30 -3:50, Hybrid (in-person ANNU Room 101 and/or on-line by Zoom)
Credits: 0.50
Academic level: Graduate

Office hours
By appointment / email me always if you need it

Course Description
The course is designed to provide a framework for the optimal use of genetic and genomic resources in animal production and the optimal approaches to changing those genetic resources in livestock. The course will cover the main animal breeding principles associated with selection for multiple traits in livestock.

Topics of the course include:

1. The role of genetics as a component of production systems.

2. Methods to optimize the use of genetic population (breed, line, composite) differences, individual animals (sires and dams), genetic and genomic evaluation in different livestock species.

3. Methods to determine traits of importance in production, including consideration of trait interactions.

4. Methods to determine economic weights and breeding objectives, and subsequent selection criteria.

5. The use of genomics tools to accelerate the genetic improvement in livestock. Improving selection efficiency by combining functional and structural genomic data with the estimation of molecular breeding values in livestock species.

6. Accelerating the translation and transformation of research knowledge in genetics and genomics to enhance innovation in Canada's dairy and beef cattle and sheep industries. Applied researches and last discoveries to increase the gain in Canada's sheep, dairy and beef cattle industries.

Course objectives

To provide learning opportunities in:

- Methods of optimizing genetic improvement strategies considering genomic and quantitative information.

- "-OMICS" technologies and methodologies to accelerate the genetic improvement in livestock.
- Improving selection efficiency by combining functional and structural genomic data with the estimation of molecular breeding values in livestock species.
- Selection in animal breeding and the importance of the genetic improvement from different points of views: academic/research, industry and farmer/production level.
- Graduate-level writing and oral presentation skills.

Materials

- Lecture slides and other materials will be posted on CourseLink.

- Invited speakers from university, industry and farm/production level will give a talk during the course related to the importance of the selection in animal breeding and the genetic improvement from different points of views. Notes from speakers will also be linked on Courselink.

- Dairy Cattle Breeding Simulation Program (DCBSP)

Medrano, J.F., A. Ahmadi and J. Casellas 2010. Dairy Cattle Breeding Simulation Program (DCBSP v.4.9), a simulation program to teach animal breeding principles and practices. Journal of Dairy Science 93:2816-2826. PMID:20494191

The DCBSP system is a dairy cattle breeding simulation program to teach undergraduate and graduate students animal breeding principles associated with selection for multiple traits in dairy cattle. The current version of the program (DCBSP v.4.9) is written in FORTRAN 90, and a web-based interface is developed for the students to interact with the program in the teaching environment. Both the backend simulation engine and the frontend web-based interface are driven by a module written in the Visual C++ programming language that loads the input files, runs the simulation, and uploads the output files onto the proper directories for each student on the web site. This software simulates a population of dairy cattle herds and artificial insemination bulls through several generations by integrating students' decisions about mating, culling, and selection of new heifers and bulls based on a multivariate animal mixed model evaluation and marker-assisted selection. The DCBSP simulation system is used locally, nationally, and internationally for teaching animal breeding principles and is hosted at the Department of Animal Science, University of California, Davis.

- Suggested (complimentary) text "Optimizing Animal Genetic Improvement (Wilton, Quiton and Quiton, 2013).

Coursework

Grades will be based on:

<u>1. Report project based on Dairy Cattle Breeding Simulation Program (DCBSP) (70%).</u>

The simulation will be run during the whole semester. I will assign two herds per student and different traits to work on. Every week we will rank the best herds based on each student decision about mating, culling, and selection of new heifers for each economically important trait assigned.

The students will prepare a draft report (few slides) showing their progress in the simulation on 2 dates TBD, for example, week 5 and week 9 of the course. This progress report can be considered a rough draft of your final project report. The instructor will review this and then make recommendations that can be combined into the final report. Each short presentation (specific dates TBD) will be 10% of the grade (each one).

The final report project should provide the summary of the results and a discussion of the decisions made regarding mating, culling, and selection of new heifers and bulls based on a multivariate animal mixed model evaluation and marker-assisted selection using the Dairy Cattle Breeding Simulation Program (DCBSP). The final report should incorporate the feedback received on the progress reports. The final report project will be 30% of the grade.

The final report will be due a week after the final exam, with specific times TBD. All reports can be submitted via the Dropbox on CourseLink.

2. Paper review and oral presentation (30%)

The paper review is designed to provide an opportunity to discuss course topics as they relate to current research in animal breeding. Student will find a research paper to review, which must be approved by the instructor. Each student will present their review in a short (~15 min) presentation during CGIL Friday workshop toward the end of the semester (March 6th and 13th), either online or in-person. Grades will be based on students' own presentation and participation in discussing others' papers. Titles and citations of two potential papers will be reviewed in class on February 5th.