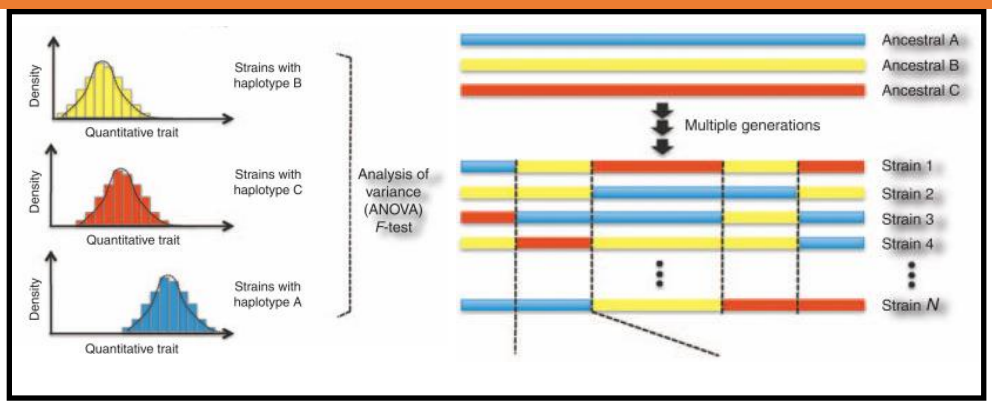
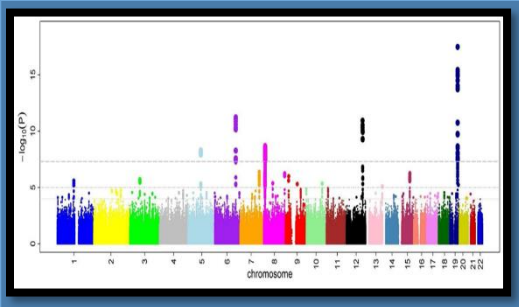
Spring 2024





GENETIC ANALYSES OF COMPLEX TRAITS IN LIVESTOCK

Course

ANS 6387 / ANS 4383

Spring 2024— 3 Credits

Lecture

Mon, Wed

3:00pm—4:15pm

ANS 102

Instructor

Dr. Raluca Mateescu

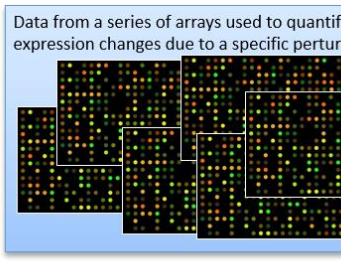
Office: Room ANS 231B,

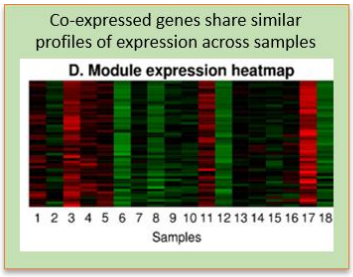
Phone: (352) 392-2367

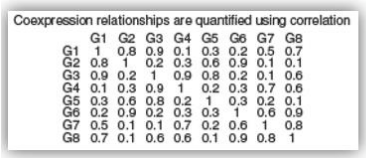
e-mail: raluca@ufl.edu

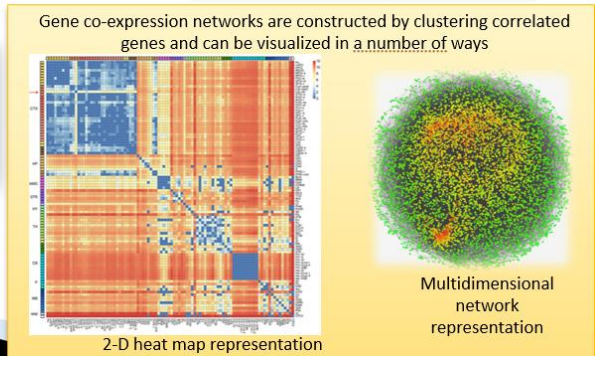
Course Objective

Comprehensive examination of principles of livestock inheritance, QTL mapping strategies and functional genomic approaches used for genomic selection and improvement programs in farm animals.









ANS 6387/4383—Genetic Analyses of Complex Traits In Livestock

Spring 2024

Lecture times **Mon. & Wed.** 3:00pm—4:15pm.

Instructor Dr. Raluca Mateescu
Office: 231B ANS; Phone: 392-2367; e-mail: raluca@ufl.edu

Student Hours: Open door and by appointment (contact Dr. Mateescu)

Course Description

Comprehensive examination of principles of livestock inheritance, QTL mapping strategies and functional genomic approaches used for genomic selection and improvement programs in farm animals.

Course Objectives

By the end of the semester, the student should be able to:

1. List and describe different molecular methods of genotyping and gene characterization;
2. Define the components of the basic genetic model for quantitative traits;
3. Define and apply various statistics used in quantitative animal breeding: mean, variance, covariance, heritability, repeatability, selection, selection response, selection intensity;
4. Describe the various factors that affect the rate of genetic change in animal breeding improvement;
5. Describe different methods of gene mapping including linkage association analyses;
6. Describe functional genomic approaches and how they can be used to find genes responsible for genetic variation in complex traits.
7. Discuss potential application of marker-assisted selection and genomics in the future of animal breeding.

Attendance Policy

All exam information will be covered during the course of the lectures. Attendance is strongly encouraged, and students are responsible for all material covered in lecture. It is highly recommended that you attend class if you expect to obtain a satisfactory grade. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Contacting the Instructor

The instructor will be available for students. Please make arrangements to visit at your convenience. If you call and I am not available, leave your name and telephone number or e-mail address and you will be contacted as soon as the message is received. **The best method to reach me is through e-mail. DO NOT WAIT UNTIL EXAMINATION TIME!**

Please ask questions in class and do not be apprehensive about concepts that might not be clear. It is important to keep up and not fall behind. Get started on the first day of class – do your homework on time – attend class – get help when you need it – and remember there is no substitute for **DAILY PREPARATION. It is much easier on all of us if you get answers to questions one or two days after class rather than one or two days before an exam.**

Text

No formal text is required. Students will be provided handouts, which are current and relevant to topics discussed in class. Optional references include:

- Lynch and Walsh, Genetics and Analysis of Quantitative Traits, Sinauer, 1998
- Cockett and Kole, Genome Mapping and Genomics in Domestic Animal, Springer, 2010

Students will be expected to read and discuss several journals articles from the following:

- Applied Animal Genomics: Results from the Field. *Annual Review of Animal Biosciences* 2:105-139. 2014
- Accelerating Improvement of Livestock with Genomic Selection. *Annual Review of Animal Biosciences* 1:221-237. 2013
- Genomics to systems biology in animal and veterinary sciences: Progress, lessons and opportunities. *Livestock Science* 166:232-248. 2014
- Understanding and predicting complex traits: knowledge from cattle. *Human Molecular Genetics*, 21:45-51. 2012
- Towards sequence-based genomic selection of cattle. Nature Genetics, 46(8):807-809. 2014
- Board-invited review: Applications of genomic information in livestock. *Journal of Animal Science*, *85*(12):3148–58. 2007
- Expression genetics and the phenotype revolution. *Mammalian Genome: Official Journal of the International Mammalian Genome Society*, *17*(6):496–502.2006
- Genome-wide association studies for complex traits: consensus, uncertainty and challenges. *Nature Reviews. Genetics*, *9*(5):356–69. 2008
- Invited review: quantitative trait nucleotide determination in the era of genomic selection. *Journal of Dairy Science*, *94*(3):1082–90. 2011
- Mapping, fine mapping, and molecular dissection of quantitative trait Loci in domestic animals. *Annual Review of Genomics and Human Genetics*, *8*:131–62. 2007
- Turning science on robust cattle into improved genetic selection decisions. *Animal: An International Journal of Animal Bioscience*, *6*(4):551–6. 2012

Exams

There will be 3 exams worth 100 points each. The final exam is not comprehensive. The material covered in the exam will be detailed prior to each exam. (*see important dates*)

Problem Sets

There will be 3 problem sets before Exam 1 worth 20 points each. Instructions and due dates will be provided in class.

Book Chapter readings and Discussion

There will be 5 reading assignments worth 20 points each. Each student will be expected to post a reading summary (200-400 words) and a couple of questions (1-5).

Article Discussion

There will be 9-10 lecture times assigned to article discussions worth 20 points each. Students will be graded on their presentation as well as participation in the discussion. Each student will be required to present at least one journal article and lead the discussion following the presentation.

Powerpoint presentations should be utilized for paper discussions. Student presenters will be expected to present and discuss the following aspects of the article:

- Brief background and objectives of the work
- Explanation of specific studies (i.e. explaining individual figures and tables) which includes a discussion of the methods utilized
- Interpretation of results
- General discussion of outcomes and future perspectives

Presentations will be graded on the following criteria (specific rubric will be provided in class and feedback will be provided following the student presentation):

- Comprehension of scientific basis for research
- Ability to describe and discuss the scientific methods utilized
- Capacity to discuss and interpret results of experiments and their implications
- Ability to lead class discussion

When not presenting, students are expected to participate in paper discussions. Participation will be evaluated on a specific rubric provided in class.

Grade Distribution

3 Exams	300 points	45.5%
3 Problem Sets	60 points	9.1%
5 Chapter Readings	100 points	15.2%
10 Article Discussions	200 points	30.3%
Total	660 points	100%

Letter grades will be assigned based upon the following scale:

A 93-100%	**B- 80-82.9%**	**D+ 67-69.9%**
A- 90-92.9%	**C+ 77-79.9%**	**D 63-66.9%-**
B+ 87-89.9%	**C 73-76.9%**	**D- 60-62.9%-**
B 83-86.9%	**C- 70-72.9%**	**E 60% and Below**

The scale may be lowered but it will not be raised.

Important Dates

No class on:

January 15: MLK Day

Exams

Exam 1: Jan 31

Exam 2: March 20

Exam 3 (final): May 2, 3pm-5pm

Tentative Outline

(Note: This schedule is subject to revision as the course progresses.)

- Introduction, overview animal breeding
- Overview of Population Genetics
- Overview of Quantitative Genetics
  - Basic statistics
  - Heritability
  - Genetic evaluation
  - Predicting response to selection
  - Factors influencing rate of genetic change
  - Comparing Selection Programs
- Intro to Genomics
- Principles of Marker-based Analysis
- Molecular Markers
- Genotyping methods
- Linkage Disequilibrium
  - Genetic Maps
- Mapping QTL
- Candidate Gene Analysis
- QTL Detection Strategies
  - Designed experiments: backcross or F2 design
  - Association Mapping
  - From Linkage analysis to gene detection
- Fine mapping
- Marker Assisted Selection/Marker Assisted Introgression
- Genomic Selection
- Genetical Genomics

The instructor reserves the right to modify the syllabus during the semester with verbal or written announcements in class. It is the student's responsibility to stay informed of such announcements.

General information

Services for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Grades and Grade Points

For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Online course evaluation process

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate

Academic Honesty

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/
  Counseling Services, Groups and Workshops, Outreach and Consultation, Self-Help Library
  Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu/
- Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Student Complaint Process

For information see https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.