

# ESSM/MEPS/EEBL 689 Special topics in Ecological Genomics Spring 2019 - 3 credits

**Meeting times and location:** 12:45-2 Tuesday and Thursday in HPCT 123x.  
Skype contact for distance students: casola.lab

## Course Description

ESSM/MEPS/EEBL 689. Ecological Genomics. (3-0). Credit 3. Genetic variation; genetic basis of adaptation; genetic maps, genotyping, RADseq, whole-genome assembly and resequencing, RNA-seq analyses; speciation genomics; genomics and life history traits; conservation genomics; phylogenomics; climate change and genomics. Prerequisites: GENE 301, 302, 310 or 412, or approval of instructor.

## Learning Outcomes or Course Objectives

Ecological genomic studies can be oriented towards a variety of objectives, including the following goals:

- Identifying the genetic basis of adaptation and the mechanisms of adaptive responses in the wild.
- Identifying processes underlying patterns of genetic variation in the wild.
- Determining mechanisms of adaptation, speciation and hybridization.
- Finding the genetic basis of phenotypic traits variation among species and populations.
- Finding the genetic basis of stress responses, and predict ecological and physiological response to projected climate changes at different scales.
- Identifying the genomic basis of life history traits (longevity and aging, life cycles, phenotypic plasticity, etc.).
- Understanding the structure and function in microbial communities.
- Familiarize with professional skills including finding and reviewing scientific articles, making scientific presentations, writing scientific projects/proposals, establishing a professional network.

**Laptops:** Students should bring their own laptop during the computer demonstrations. If this is not possible, they should contact the instructor. The use of laptops during the paper discussion and presentation is NOT allowed.

## Instructor Information

Name: Dr. Claudio Casola, Assistant Professor, ESSM Department  
Phone: (979) 845-8803  
email: [ccasola@tamu.edu](mailto:ccasola@tamu.edu)  
Office hours: by appointment (HFSB 317)

## Resource Material

Reading assignments (papers) will be provided a few days up to a week in advance. A list of papers will be provided on the course website.

The book *Molecular Ecology* (2<sup>nd</sup> edition) edited by J.R. Freeland, H. Kirk and S. Petersen will be used to introduce some key concepts of the course. The book is available online at TAMU University Libraries (<http://onlinelibrary.wiley.com/book/10.1002/9780470979365>)

## Course Topics, Calendar of Activities, Major Assignment Dates

Readings and discussions: One or two papers (no review papers!) will be assigned before each session, including sessions with computer demonstrations. Papers may be suggested by the students and will be approved by the instructor. **Students will present the paper and lead the discussion** according to a schedule that will be determined at the beginning of the semester. All students will be required to **fill in a reading questionnaire** about the paper(s) of the day before coming to class. For the presentation, a few **PowerPoint slides** with a background of the topic, and the paper main goals, methods, figures and tables, and conclusions should be put together by the student leading the discussion (meeting with the instructor a few days before presenting the paper is recommended but not required). Distance resources to help put together an effective presentation and leading a discussion will also be provided.

Homework: Written homework will be assigned in class and/or on the course website. The objective of the homework is to help students practice the nuts-and-bolts computations of population genetics, population genomics and transcriptomics, using available data sets. Answers to the homework will be available on the course website within 1-2 days after the class session at which the homework is due. Late assignment submissions will not be accepted, unless prearranged with the instructor or in an emergency situation.

Final project: The project consists in the analysis of available or novel genomic data by **teams of 2-4 students, to be formed within 2 weeks of the class start**. The results of the analysis should be novel and accurate enough to be suitable for publication. Further instructions and recommendations on the final project will be provided during the semester. Final projects should be chosen **before spring break**. The final projects are due by the end of week 14. Each student will also provide a review of the final project of the other teams.

*Distance section:* students attending the course online will be able to participate to all classroom activities. A Skype or TTV connection will be used for distance live communications. To facilitate participation, all students will receive each presentation and will be required to send their comments on reading assignments a day in advance. Detailed instructions regarding the bioinformatics sessions will be sent to all students at least a week in advance. Distance communications will be available during office hours and whenever scheduled. All sessions will be recorded with **Camtasia** and posted on **eCampus** and **Google Drive** to allow all students to review them. Distance students with schedule conflict due to other classes they are enrolled in will be participating to discussion by providing written comments after reviewing the class audio/video.

### Tentative schedule

Module	Topic	Activities	Time
M1	<b>Introduction to Ecological Genomics.</b> Fundamental questions and approaches.	Reading activity: Chapter 1 of book. Reading questionnaire on Chapter 1.	Est. 8 hrs
M2	<b>The Ecological Genomics Toolkit.</b> Genetic maps, genotyping, RADseq, whole-genome assembly and resequencing, RNA-seq analyses. Professional skills development: How to make a presentation.	Reading activity: Selected sections of Chapter 2 of book. Assigned papers. Reading questionnaire on Chapter 2 and papers. Student-led presentation and discussion of papers.	Est. 10 hrs
M3	<i>Bioinformatic session.</i> <i>Detection and analysis of SNPs.</i>	Reading activity: Selected sections of Chapter 2 of book. Assigned papers. Reading questionnaire on Chapter 2. In-classroom exercises. Homework 1 assignment.	Est. 12 hrs
M4	<b>Subject: Genomics of Adaptation.</b> Professional skills development: How to review a paper.	Reading activity: Selected sections of Chapter 3 of book. Assigned papers. Reading questionnaire on Chapter 3 and papers. Student-led presentation and discussion of papers. Homework 1 due.	Est. 12 hrs
M5	<b>Subject: Genomics of Adaptation (cont.).</b> Professional skills development: Recommendations and resources for scientific writing.	Reading activity: Selected sections of Chapter 3 of book. Assigned papers. Reading questionnaire on Chapter 3 and papers. Student-led presentation and discussion of papers.	Est. 10 hrs
M6	<i>Bioinformatic session.</i> <i>Population structure analyses.</i>	Reading activity: Selected sections of Chapter 4 of book. Assigned papers. Reading questionnaire on Chapter 4. In-classroom exercises. Homework 2 assignment.	Est. 12 hrs
M7	<b>Subject: Speciation Genomics.</b>	Reading activity: Selected sections of Chapter 4 of book. Assigned papers. Reading questionnaire on Chapter 4 and papers. Student-led presentation and discussion of papers.	Est. 12 hrs

		Homework 2 due.	
M8	<b>Subject: Speciation Genomics.</b> Professional skills development: How to write a final project.	Reading activity: Selected sections of Chapter 4 of book. Assigned papers. Reading questionnaire on Chapter 4 and papers. Student-led presentation and discussion of papers. Final projects announcements.	Est. 12 hrs
M9	<i>Bioinformatic session.</i> <i>Identify molecular signatures of adaptation using population genomic data.</i>	Reading activity: Selected sections of Chapter 5 of book. Assigned papers. Reading questionnaire on Chapter 5. In-classroom exercises.	Est. 12 hrs
M10	<b>Subject: Conservation Genomics.</b>	Reading activity: Selected sections of Chapter 5 of book. Assigned papers. Reading questionnaire on Chapter 5 and papers. Student-led presentation and discussion of papers.	Est. 12 hrs
M11	<b>Subject: Genomics and Life History Traits.</b> Professional skills development: How to find the right journal for your paper.	Reading activity: Selected sections of Chapter 5 of book and assigned papers. Reading questionnaire on Chapter 5 and papers. Student-led presentation and discussion of papers.	Est. 10 hrs
M12	<b>Subject: Genomics and Life History Traits.</b> Professional skills development: Create your professional network using social media.	Reading activity: assigned papers. Reading questionnaire on papers. Student-led presentation and discussion of papers. First review of final projects.	Est. 10 hrs
M13	<b>Subject: Phylogenomics.</b>	Reading activity: assigned papers. Reading questionnaire on papers. Student-led presentation and discussion of papers. Second review of final projects.	Est. 10 hrs
M14	<b>Subject: Climate Change and Genomics.</b>	Reading activity: assigned papers. Reading questionnaire on papers. Student-led presentation and discussion of papers. Final projects due.	Est. 10 hrs
M15	<b>Project presentation</b>	Students presentation and discussion of final projects. Cross-review of projects between teams.	Est. 10 hrs

## **Grading Policies**

Overall course percentage grade will be determined from a weighted average of:

- Attendance: 5%
- Active participation in classroom discussions (including questionnaires): 20%
- Leading discussions: 20%
- Homework: 15%
- Final Project: 30%
- Review of Final projects: 10%

Grade scale: A = 90-100; B = 80-89; C = 70-79; D = 60-69; F = less than 60

## **Attendance and Make-up Policies**

The attendance policy will follow indications from the Section 7 of the Texas A&M University Student Rules (<http://student-rules.tamu.edu/rule07>). In order to earn all possible participation points, perfect attendance is expected; otherwise, the student must inform the instructor as soon as possible about the reason for the absence, and he/she should provide documentation substantiating the reason for his/her absence whenever possible.

## **Americans with Disabilities Act (ADA)**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit <http://disability.tamu.edu>.

(Updated 11/5/2015 due to change in office location)

## **Academic Integrity**

For additional information please visit: <http://aggiehonor.tamu.edu>

*“An Aggie does not lie, cheat, or steal, or tolerate those who do.”*