WFSC/GENE 648 Molecular Evolution
Spring 2020 - 3 credits

Time: TR 3:55-5:10
Location: BICH 221A (room N-127)

Instructor
Dr. Claudio Casola
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Office Hours: by appointment
Office: HFSB 317

Course Description
Students in this course will examine the theory and tools used in the analysis of molecular evolutionary patterns of DNA, RNA and protein sequences. The course format includes lectures by the instructor, student-led discussions of both foundational and current papers, preparation of an independent research project, oral presentations, and practice in the peer-review process.

Prerequisites
Basic knowledge from courses in genetics, evolution, and statistics are required for enrollment. Coursework focused on phylogenetics, population genetics and related subjects is recommended but not required.

Learning Outcomes
At the end of this course students will share an extensive understanding on how evolutionary processes act at the molecular level. They should also be able to identify fundamental questions in molecular evolution and the critical links between molecular and organismal evolution. I expect students taking this class to further develop throughout the semester their ability to critically analyze and evaluate past and current research in this field, to deliver concise and coherent oral arguments and research presentations, and to work together to produce and scientific research in molecular evolution. Through a series of professional skills mini-workshops

Course credit
3 semester hours, based on two one-hour lectures/discussions per week.

Recommended Books (no textbook required)
- Lynch, M. 2007. The Origins of genome Architecture. Sinauer
- Graur, D. 2016. Molecular and Genome Evolution. Sinauer

Assignments

Student-led discussions. Each student will lead several classroom discussions based on reading assignments (papers). The schedule of the discussions for the whole semester will be set up in the first week of class. Students in charge of the discussion will introduce assigned papers using slides (PowerPoint, PDF, Keynote, etc.), which should be sent to me for review at least 3 days before the discussion. A list of reading assignments (papers) for each topic will be given before the beginning of the semester and further reading assignments might be provided throughout the semester. Students are welcome to suggest papers to read on specific topic as long as they do so at least a week before the scheduled discussion on that topic.

Reading assignment questionnaire. Each student is required to send, *via email only*, a filled in discussion questionnaire provided by me prior to the discussion session.

In-class participation. Each student is required to participate in paper discussions with questions, comments, and insights. Students can use their completed questionnaire to facilitate their participation.

Final project. A major goal of the course is for students to be able to develop a research project in any area of molecular evolution. For this final project, teams of 2-3 students will be formed early in the semester. The requirements for the project are: 1) It must be a novel, unpublished research; 2) It should be based on either a genome-wide analysis or the study of a group of genes across multiple species; 3) It must lead to a written assay of 8-12 double-spaced pages of text with additional pages of references and at least two figures. I will provide a few topics at the beginning of the semester to choose from, but any suggestion from students on the final project is more then welcome. Each team will present their project at the end of the semester. A draft of the project is required by the end of week 8, and a paper describing the final project will be due two weeks before the end of class. Each student will provide a written review (up to a page in length) for the final project papers of all other teams. Final project teams will be assembled during the first month of the semester. Although I encourage teams to self assemble, I will make recommendations if needed to ensure that each team is balanced in terms of the expertise and experience of their members.

Course Schedule (Subject to Change)

Module	Topic	Activities	Time
M1	**Introduction to molecular evolution.** Fundamental questions and approaches. **Presentation of possible final projects by the instructor.**	Reading activity: Seminal papers Molecular Evolution questionnaire.	Est. 8 hrs.
M2	**DNA and Amino Acid Sequence Evolution** Professional skills development: How to make a presentation.	Reading activity: assigned papers and questionnaire. Student-led presentation and discussion of papers. **Final project: creation of teams and selection of projects.**	Est. 10 hrs.
M3	**Mutations and substitutions**	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers.	Est. 12 hrs.
M4	**Signatures of natural selection and adaptation in genome sequences** Professional skills development: How to review a paper.	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers.	Est. 12 hrs.
M5	**Molecular clock, molecular phylogenetics and**	Reading activity: assigned papers questionnaire.	Est. 10 hrs.

	phylogenomics Professional skills development: Recommendations and resources for scientific writing.	Student-led presentation and discussion of papers.	
M6	**Gene family evolution through gene duplication and gene loss**	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers.	Est. 12 hrs.
M7	**Horizontal gene transfer; *de novo* gene formation**	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers.	Est. 12 hrs.
M8	**DNA repeats, transposable elements, genome evolution and innovation** Professional skills development: How to write a final project.	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers. **First submission of final project paper.**	Est. 12 hrs.
M9	**Genome variation and evolution: SNPs and copy-number variants (CNVs)**	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers.	Est. 12 hrs.
M10	**Whole-genome duplications, gene dosage and evolution**	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers.	Est. 12 hrs.
M11	**Genomics and Life History Traits.** Professional skills development: How to find the right journal for your paper.	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers.	Est. 10 hrs.
M12	**Genomics and Life History Traits.** Professional skills development: Create your professional network using social media.	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers. First review of final projects.	Est. 10 hrs.
M13	**Evolution of gene regulation**	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers. Second review of final projects.	Est. 10 hrs.
M14	**Experimental Molecular Evolution**	Reading activity: assigned papers questionnaire. Student-led presentation and discussion of papers. **Final projects due.**	Est. 10 hrs.
M15	**Project presentation**	**Final project: student presentation and discussion of final projects.** Cross-review of projects	Est. 10 hrs.

		between teams.	

Grading
[91–100% = A; 81–90% = B; 71–80%= C; 61–70 = D; ≤ 60 = F]

Grades will be based on:
- Leading paper discussion (15%)
- In-class participation (15%)
-Questionnaires on reading assignments (15%)
-Final project in-class presentation (15%)
-Final project paper (30%)
-Review of other project papers (10%)

Late submissions will result in grade penalties.

Attendance
Students are responsible for providing satisfactory evidence to substantiate the reason for an absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07).

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

Academic Integrity Statement and Policy
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do."
Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning and to follow the philosophy and rules of the Honor System. Ignorance of the rules does not exclude any member of the Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit http://aggiehonor.tamu.edu/ . On course work, assignments, and examinations at Texas A&M University, you may be asked to sign the following Honor Pledge:
"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work."