

Syllabus details: OEB 230: Comparative and Evolutionary Genomics
Fall 2021
Thursdays: 9:30-11:30 am
Room location: HUH 125

Instructor: James Mallet

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Office Hours: Rm. 4092, Biolabs, 11:30am - 12:30pm Thursday (or by arrangement)

[Link to provisional schedule](#)

[Readings](#)

Course description

With each new advance in technology, our views of evolution have changed dramatically. For example, the discoveries of DNA as the hereditary material, of redundancy in the amino acid code, and of non-coding DNA have all led to an appreciation of entirely new kinds of evolution.

With the ability to sequence whole genomes rapidly, there have been revolutionary changes in the study of phylogenetics, neutral evolution, adaptation, and speciation, and these advances are set to continue into the near future. We are now able to answer questions about genome evolution, evolutionary mechanisms, phylogeny, and genome architecture that were once shrouded in mystery. As an example, we can today quantify the impact on the entire genome of horizontal gene transfer and introgressive hybridization in eukaryotes; gene flow between species is now believed to be more important than it was 50 years ago. With such "big data" now contributing to the field of evolution, there are major computational challenges to be overcome, and considerable turmoil in how to make inferences. In any case, it's an especially exciting time to be a young researcher: graduate and undergraduate students are contributing very strongly to this field because they often acquire a better understanding of the latest advances in genomics and have more advanced bioinformatics skills than their own supervisors! (And your instructor speaks from personal experience, here).

This course will survey modern ideas in comparative and evolutionary genomics, using studies in microbes, plants and animals, and how they have changed radically as a result of these genomic approaches. As well as readings and discussions in class, the course will involve online zoom conversations with major players in the field of evolutionary genomics.

Course format:

The course meets weekly for a two-hour discussion of the week's topic. It is intended as a survey of major concepts through the methods of active workers in the field, their philosophy and approach, and the results that have flowed from them. (Please note: The course is not intended to provide hands-on help with coding or bioinformatics, nor will it delve deeply into mathematical population genetics or genomic methods. On the other hand, the importance of such skills to this burgeoning field will become increasingly evident during the semester). Each meeting will begin with a discussion of one or two recent publications based on a major theme in the field, and the instructor and TF will try to guide the discussion from basic background, through the specifics of the publications reviewed. On most weeks, we plan to have a ~ 30 min zoom or in-person meeting with an expert, usually the author of the papers we read, in this field following the discussion. Students will be responsible for asking questions and initiating discussion. Questions can range from technical details of the work to more general questions about the future of the field or personal experiences as a researcher. The last 15 mins of the class will be an in-house discussion of the material and a summary.

Learning objectives:

By the end of this course, students are expected to:

- Have a good understanding of the breadth of this recent field
- Understand major controversies and how genomics approaches might (or might not) help
- Develop an ability to converse with cutting-edge researchers in the field
- Develop a view on the future of genomics approaches in the understanding of evolutionary biology, as well as on the increasing importance of evolutionary biology in molecular biology and genomics.

Who should take this course:

(A) Graduate students, especially those interested in applying genomics technologies to work in evolution.

(B) Advanced undergraduate students interested in evolutionary biology and likely to take higher degrees in molecular or evolutionary biology, or a related topic such as medical applications of genomics.

Prerequisites:

The course will build on a general understanding of evolution to topics not found in other courses. Students will usually have taken a basic undergraduate course in evolution (e.g. OEB 53), genetics and genomics (OEB 50) and/or population genetics (e.g. OEB 242). Other courses will be considered. If in doubt, consult the course instructor. In the past, we've often made exceptions, and we'll be pretty lenient with pre-requisites, but those who would benefit most will already have a strong curiosity about the topics covered, or at least think that they might.

Written work:

- A weekly news-style paragraph on each reading in your own words, mentioning important points, and a critical overview (not just a summary).
- Term paper on a topic about evolutionary genomics of your own preference: due in reading week 6 Dec 2021. About 10 pages, correctly referenced with citations.

Grading:

There is a letter grade for this course. However, it is a discussion course, and the goal is more to get the students to read the material, form opinions, and discuss them in class, than to rank the students. Thus the TF will keep a record of your contributions in class (33%), and we'll jointly check your weekly paragraphs (33%). We'll also grade the final paper (34%).

Academic Integrity:

Meetings with fellow students outside class to discuss these topics and the readings is encouraged, but you should always write and submit your own written work. If you lift a quotation from a publication, you should put it in quotation marks. You should always cite your sources fully for all quotations, information, or ideas other than your own.