# Introduction to Genome Science - BISC 434
# Syllabus - 2018 Spring Semester

**Basic Information**

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| *Course:* | Introduction to Genome Science, BISC 434, 4 credits |
| *Textbook*: | Arthur M. Lesk. Introduction to Genomics (3rd Edition). Oxford University Press. |
| *Place and Time:* | Monday and Wednesday: 9:30 am - 10:50 am<br>Location: RRI421 |
| *Faculty:* | Dr. Ian Ehrenreich<br>Associate Professor, Molecular and Computational Biology |
| *Office:* | 319A Ray I. Irani Building. |
| *Telephone:* | 213-821-5349 |
| *Email:* | ian.ehrenreich@usc.edu |
| *Office Hours:* | Tuesday 1:00 pm – 2:00 pm or by appointment |
| *Online Resources:* | Will be provided using Dropbox links |
| *Final Exam:* | Friday, May 4th from 8:00 am – 10:00 am |
| *Report Deadline:* | Students are expected to generate a presentation based on a topic in genomics. A report on this topic is due during finals week and must be turned in by midnight on Monday, May 7th at the latest. |

**Course Goals and Learning Objectives**

Characterizing the sequence, function, and evolution of genomes is a central focus of modern biology. In this course, we will learn about the core questions and methods of genome scientists. We will discuss techniques for comprehensively examining organisms at the levels of DNA, RNA, proteins, and metabolites. We will also talk about how this information is used to determine the molecular basis of phenotypes, such as evolutionary adaptations, crop improvements, and human disease. The goal of this course is for students to walk away conversant in modern genomics techniques and the biological problems genome researchers hope to solve. This course is best suited for students that have taken BISC325 or BISC502a, or have had equivalent prior training in genetics or molecular biology.

**Required Materials**

- Textbook: Lesk (see above).
- Additional readings will be provided on Blackboard throughout the course.

**Classroom Policy**

Any electronic communication devices (phones, blackberries, and similar) must be turned off, and no instant messenger/chat type programs are allowed in class.

**Course Plan**

The class will initially involve lectures on each chapter in the textbook as well as guided discussions of papers that expand upon content in the textbook, and will build to the point where students are capable of presenting on a relevant topic of their choosing. The following is the anticipated schedule for the class; however, please note this is subject to change.

| Week | Date | Topic | Chapter in Book |
|---|---|---|---|
| 1 | January 8, 2018 | Introduction and background | 1 |
| | January 10, 2018 | The human genome project: achievements and applications | 2, Paper |
| 2 | January 15, 2018 | *No class – MLK Day* | |
| | January 17, 2018 | Mapping: sequencing, annotation, and databases I | 3 |
| 3 | January 22, 2018 | Mapping: sequencing, annotation, and databases II | Paper |
| | January 24, 2018 | Evolution and genomic change I | 4 |
| 4 | January 29, 2018 | Evolution and genomic change II | Paper |
| | January 31, 2018 | Genomes of prokaryotes and viruses I | 5 |
| 5 | February 5, 2018 | Genomes of prokaryotes and viruses II | Paper |
| | February 7, 2018 | Genomes of eukaryotes I | 6 |
| 6 | February 12, 2018 | Genomes of eukaryotes II | Paper |
| | February 14, 2018 | Comparative genomics I | 7 |
| 7 | February 19, 2018 | *No class – Presidents' Day* | |
| | February 21, 2018 | Comparative genomics II | Paper |
| 8 | February 26, 2018 | **Exam 1** | **First Half of the Class** |
| | February 28, 2018 | The impact of genome sequences on human health and disease I | 8 |
| 9 | March 5, 2018 | The impact of genome sequences on human health and disease II | Paper |
| | March 7, 2018 | Genomics and anthropology: Human evolution, migration, and domestication of plants and animals I | 9 |
| 10 | March 12, 2018 | *Spring Break* | |
| | March 14, 2018 | *Spring Break* | |
| 11 | March 19, 2018 | Genomics and anthropology: Human evolution, migration, and domestication of plants and animals II | Paper |
| | March 21, 2018 | Transcriptomics I | 10 |
| 12 | March 26, 2018 | Transcriptomics II | Paper |
| | March 28, 2018 | Proteomics I | 11 |
| 13 | April 2, 2018 | Proteomics II | Paper |
| | April 4, 2018 | Metabolomics I | 12 |
| 14 | April 9, 2018 | Metabolomics II | Paper |
| | April 11, 2018 | Systems biology I | 13 |
| 15 | April 16, 2018 | Systems biology II | Paper |
| | April 18, 2018 | Student Presentations | |
| 16 | April 23, 2018 | Student Presentations | |
| | April 25, 2018 | Student Presentations | |
| | See finals schedule | **Exam 2 (Non-Cumulative)** | **Second Half of the Class** |

**Class format**

Attendance at all classes is required, unless an excused absence is obtained. Students are expected to have carefully read and be capable of discussing each chapter or paper prior to class meetings.

**Paper Discussions**

Many of the classes will be discussions, in which one or two papers will be read and analyzed as a group. Students should come prepared with questions and comments on the paper. Further, *each student is expected to lead one class discussion*, with the specific dates determined by sign-up. Paper discussions will be a significant component of the 'Participation' grade described below.

**Assessment**

Grades will be based on four scores: 1) midterm exam grade, which will test understanding of material from the first part of the class, 2) final exam grade, which will largely focus on material from the second part of the class but will expect understanding of material from throughout the class, 3) final presentations, and 4) class participation:

| Assessment Procedure | Percent |
|---|---|
| Midterm | 25% |
| Final | 25% |
| Final project presentation and report | 25% |
| Participation | 25% |

*Criteria for grading:* The midterm and final exams will consist of a mixture of multiple choice, fill-in-the-blank, and free response questions. Some of the free response questions will ask students to formulate strategies for solving biological problems using tools from genomics. The final presentation and report will be graded according to clarity of scientific hypothesis, appropriateness of data to address that hypothesis, ability of the student to effectively communicate their strategy, and on the substance of their conclusions.

*Final presentation:* Students will give a 20-minute presentation to the rest of the class. Presentations will occur during the final three course meetings. Each presentation should include a number of slides that describe a biological problem of interest and how it could be addressed using genomics techniques. Accompanying this talk, students will be expected to provide a single-spaced, 5-page paper describing the problem, methods to address the problem, and the potential range of outcomes for the proposed experiments. The paper should be written in Arial font with a font size of 12 and 1-inch margins on each side of the page. Primary literature should be used to reference salient points, and at least 15 papers should be referenced. If enrollment for the class is higher than expected, the course schedule and allocation of time to each presentation may be modified to accommodate all student presentations.

*Participation:* Participation grades will be assessed based on attendance, quality and quantity of participation during paper discussions, performance in leading a paper discussion, and other factors, such as questions asked during lecture.

*Course grade:* The course is not curved. Letter grades will follow a straight scale: 90% and above leading to A, between 80% <90% leading to B, etc. Pluses and minuses are assigned by dividing each range in corresponding halves (A, A-) or thirds (B+, B, B-, C+, ...).

**Statement on Academic Conduct and Support Systems**

All USC students are responsible for reading and following the Student Conduct Code, which appears in the SCampus and at https://scampus.usc.edu/university-student-conduct-code/. This policy does not apply to discussion or exchange of ideas. On the contrary, such interactions represent an important way to clear programming hurdles.

**Academic Conduct**

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety* http://dps.usc.edu/contact/report/. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *Relationship and Sexual Violence Prevention and Services* https://engemannshc.usc.edu/rsvp/ provides 24/7 confidential support, and the sexual assault resource center webpage http://titleix.usc.edu describes reporting options and other resources.

**Support Systems**

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu/ will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

**Paper Readings**

*January 10, 2018*
International Human Genome Sequencing Consortium. 2001. Initial sequencing and analysis of the human genome. Nature.

*January 22, 2018*
The 1000 Genomes Project Consortium. 2015. A global reference for human genetic variation. Nature.

*January 29, 2018*
Burga et al. 2017. A genetic signature of the evolution of loss of flight in the Galapagos cormorant. Science.

*February 5, 2018*
Hutchison III et al. 2016. Design and synthesis of a minimal bacterial genome. Science.

*February 12, 2018*
Komor et al. 2017. CRISPR-based technologies for the manipulation of eukaryotic genomes. Cell.

*February 21, 2018*
Riley et al. 2016. Comparative genomics of biotechnologically important yeasts. PNAS.

*March 5, 2018*
Sekar et al. 2016. Schizophrenia risk from complex variation of complement component 4. Nature.

*March 19, 2018*
Nielsen et al. 2017. Tracing the peopling of the world through genomics. Nature.

*March 26, 2018*
GTEx Consortium. 2017. Genetic effects on gene expression across human tissues. Nature.

*April 2, 2018*
Huttlin et al. 2017. Architecture of the human interactome defines protein communities and disease networks. Nature.

*April 9, 2018*
Hackett et al. 2016. Systems-level analysis of mechanisms regulating yeast metabolic flux. Science.

*April 16, 2018*
Shapiro et al. 2018. A CRISPR-Cas9-based drive platform for genetic interaction analysis in *Candida albicans*. Nature Microbiology.