

## Biology 431 (BIOL431): Genome Sciences and Genomic Medicine

Spring 2020

**Description:** This course will be focused on the study of genomes, genomic techniques, and how these approaches are and will be used in medical diagnosis and the treatment of human disease. The class will be split into four broad sections, which are 1) studying genomes, 2) functional genomics, 3) genomic techniques, and 4) genomic medicine. Topics of study will include genome sequencing, analysis of genome sequences, genome projects (including the human genome project), microarrays, new high-throughput sequencing technologies, proteomics, metabolomics, and reverse genetic analysis with a focus on genome-wide mutant collections.

**Time:** 1:30 p.m. – 3:00 p.m., Tuesdays and Thursdays

**Prerequisites:** BIOL221 (required); BIOL421 (recommended)

**Class Procedure:** Each one-and-a-half-hour class period will consist of an in-class activity or a lecture on that day's topic. If directed beforehand, students should perform the suggested preparatory activities before the class period. Much of this course will consist of active learning activities, which may require some pre-class preparation.

**Place:** Levin 111

**Instructor:** Brian Gregory (103H Carolyn Lynch Laboratory, appointments by request); email: [bdgregor@sas.upenn.edu](mailto:bdgregor@sas.upenn.edu)

**Teaching Assistants:** Rong Guo (104 Carolyn Lynch Laboratories, Thursdays 3:00-4:00 pm), email: [ronguo@sas.upenn.edu](mailto:ronguo@sas.upenn.edu) and Zach Oppler (301 Leidy Laboratories, Tuesdays 4:00-5:00 pm), email: [zoppler@sas.upenn.edu](mailto:zoppler@sas.upenn.edu)

**Textbooks & web-site:** **A Primer of Genome Science, 3<sup>rd</sup> edition (Sinaur)**  
*Gibson and Muse* (**Textbook is not required and only suggested as a reference in addition to the in-class material**)

Additional material, including practice problem sets, lecture notes, etc. will be distributed via the Canvas site  
([Course Canvas Site Link](#)), accessible using your PennKey

**Grading:** Each student's grade will be based on in-class participation during the genomics-related activities, two midterm exams, and a final paper, each counting for 1/4 of the student's final grade. The two midterm exams will consist of an in-class section and a limited take-home section that students can work on together, but each student must turn in their own written document. For the paper, students will turn in a rough draft 3 weeks before the due date on April 9, 2020. Dr. Gregory will then meet with all students the following week (April 13 – 17, 2020) to discuss the paper and means for improvement.

- **Graduate students** will have the additional assignment of reading genomics-related primary literature and writing a 1-page synopsis once per month. Clarity and understanding of the results and concepts will be assessed for grading purposes.

## Course Schedule

Date	Topic
Jan. 16	Introduction to Genomics (APSG pages 1-12), <b>in class activity</b>
Jan. 21	Genome Sequencing I (APSG pages 13-58), <b>in class activity</b>
Jan. 23	Genome Sequencing II (APSG pages 65 -107), <b>in class activity</b>
Jan. 28	High-throughput Sequencing I (APSG 79-83, mostly from notes), <b>in class activity</b>
Jan. 30	High-throughput Sequencing II (APSG 79-83, mostly from notes)
Feb. 4	Comparative Genomics I (e.g. Gene Ontology) (APSG 10-12, 113-129), <b>in class activity</b>
Feb. 6	Comparative Genomics II (APSG 107-112, 225-230)
Feb. 11	Tools for Studying Genomes I – Databases and web browsers (APSG Chapter 1, but mostly from notes), <b>in class activity</b>
Feb. 13	Tools for Studying Genomes II – Genomics Techniques (APSG Chapter 1, but mostly from notes), <b>in class activity</b>
Feb. 18	Tools for Studying Genomes III – Genomics Techniques (APSG Chapter 1, but mostly from notes), <b>in class activity</b>
Feb. 20	Tools for Studying Genomes IV – wrap-up (APSG pages 90 -91, mostly from notes)
Feb. 25	Introduction to RNA Genomics (APSG 191-224)
Feb. 27	<b><i>Exam 1 (covers material through Feb. 21)</i></b>
Mar. 3	Transcriptomics I (APSG 191-255), <b>in class activity</b>
Mar. 5	Transcriptomics II (APSG 231-255, and notes)
Mar. 9-13	<b><i>Spring Break</i></b>
Mar. 17	Transcriptomics III (APSG 231-255, and notes), in class activity
Mar. 19	<b><u>Research Lecture: Using Genomics to Study the Transcriptome</u></b>
Mar. 24	Protein Structure (APSG 286-294, and notes)
Mar. 26	Proteomics I (APSG 259-286), <b>in class activity</b>
Mar. 31	Proteomics II (APSG 259-286)
Apr. 2	Genomics in Medicine -- Human Variation I (APSG Chapter 3), <b>in class activity</b>
Apr. 7	Genomics in Medicine -- Human Variation II (APSG Chapter 3)
Apr. 9	Genomics in Medicine – GWAS I (notes and handouts), <b>in class activity</b>
Apr. 14	Genomics in Medicine – GWAS II (notes and handouts) <b><i>Paper rough draft due</i></b>
Apr. 16	Genomics in Medicine -- Personalized Medicine I (APSG 243-246), <b>in class activity</b>
Apr. 21	Genomics in Medicine – Personalized Medicine II (see notes and handouts)

Apr. 23

Mutant Collections and Metabolomics (APSG Chapter 6), **in class activity**

Apr. 28

***Exam 2 (covers material through April 21)***

May 10

***Final Exam (due)*** – The final exam will be a paper covering some aspect of genomics that has truly interested each student. Paper should be 10 – 15 pages in 12-point font with 1 inch margins, and a line spacing of no smaller than 1.5. Topics should be discussed with Dr. Gregory in mid-March to give ample time for finishing rough draft before April 9<sup>th</sup>.