

BIO5150/7150 “Genomics” Course Syllabus

Fall Semester, 2019

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CLASS MEETING LOCATION

1177 Biological Science Building (BSB)

CLASS MEETING TIME

Tuesday and Thursday, 10 a.m. to 11:15 a.m.

OFFICE HOURS

Tuesday and Thursday 2-3pm, BSB5107

COURSE REQUIREMENTS

A familiarity with biology, basic biochemistry, genetics, and molecular and cellular biology is necessary. It is assumed that students have basic training in computation, math and statistics. All students should be able to access computers and Internet.

PREREQUISITE

BIO3070 Genetics or equivalents, or consent of instructor.

COURSE MATERIALS

Textbook: not required.

Recommended reading textbooks:

Introduction to Genomics, 2nd edition, by Arthur M Lesk, Oxford University Press, 2012.

Genomes 4, by T.A Brown, Garland Science 2017.

Lecture slides: Lecture slides will be provided on Canvas one day before class

Papers assigned in class and homework: Journal articles for lecture and homework assignments will be posted in Canvas before the lecture and/or homework assignment.

COURSE DESCRIPTION AND OBJECTIVES

This course will introduce the theory and practice of genomics. Topics include overview of genomes, sequencing and mapping, comparative genomics, transcriptomes, population genetics and genomics, basic bioinformatics, population-level variation (SNPs, MNPs, indels), ethics, evolutionary genomics, and functional genomics. This course is designed to lead biology, genetics, and molecular and cellular biology-oriented

junior and senior undergraduate and graduate students to the field of genomics.

The objective of this course will familiarize students with the tools and principles of contemporary genomics. By the end of the course, students will have a working knowledge of current genomics technology and approaches as well as the types of databases and computational tools available.

- Familiarize students with genomic methods.
- Encourage students to think on genomic scale.
- Excite students about hottest areas of biology.
- Demystify modern genomics methods and concepts.
- Introduce *necessary* jargon.
- Discover basic biology in the context of theoretical and applied genomics research.
- Know the broad applications of genomics.
- Become proficient with basic web-based tools to "do" genomics.
- Appreciate the benefits of using math and computer sciences to understand biology in genome scale.

METHOD(S) OF INSTRUCTION:

Lectures

EXAMS

There will be one in-class midterm examinations on **Thursday, Oct. 17th, 2019**. The final exam will be non-cumulative and only cover the material presented after midterm. The final exam will be held on **Friday, Dec. 13th, 2019**, 10:15am-12:15am.

Both exams are mandatory and may not be dropped.

HOMEWORK ASSIGNMENTS

There will be four open-book homework assignments. The homework assignment is due in one (1) week after it is assigned. Seventy-five (75) points/assignment.

QUIZZES

Five quizzes will be held in unannounced lecture day. Quiz will be held in before or last 5-10 minutes of lecture. Each quiz has 2-5 short-answer questions. Each quiz will cover the material from the lectures preceding the quiz. Each quiz will have a maximum score of 10 points. **No make-ups** for quizzes.

TEAM RESEARCH PROJECT AND PRESENTATION

A team will be formed to conduct a genome research project and write a term paper. The topics of project will be distributed and selected by the team. Team may seek your own topics, but it has to be GENOME-related research project and approved by Dr. Fan. Projects should be accomplished by relying on online databases and online genomic analysis tools. Nevertheless, if students are familiar with some stand-alone programs and software, you are welcomed to utilize them to conduct your project. The project will be performed as team (generally 2-3 students/team). The team must be formed by BIO7150 student(s) and BIO5150 student(s), unless assigned otherwise by Dr. Fan. The format of

term paper will follow the formal journal paper including **Introduction, Methods, Results, Discussion, and References**. Five pages with single space (12/11 Times New Roman) is minimum. **NO COPYING AND PLAGIARISM**. It is unacceptable for you to "borrow" text from another student or any document, or electronic source unless you explicitly cite the reference. Copying, plagiarism, academic theft or dishonesty for term paper will be treated as fail for the project. The term paper will have to be typed and handwriting is unacceptable. The term paper is due on **Wednesday, December 11, 2019**.

Project presentation: each team member will have to present. The final score of presentation will be judged by team (50 of 100) and individual performance (50 of 100). The presentation time will be 5-10 min/team member using power point slides.

HONOR REGISTRATION

For BIO5150 students, if you enroll in the honors section of this course, you will not be allowed to transfer to the non-honors section after two weeks following the start of the semester. If you are unable to complete the work for the honors section during the semester, you will be given the grade of Incomplete in the class. You will have one year to finish the work and change your grade from incomplete to a letter grade. Failure to complete the honors section work in the one year period will result in a change from an incomplete to an F for the course.

GRADING:

- Midterm: 250
- Final exam: 200
- Homework assignments: 300 (4×75)
- Project term paper: 100
- Project presentation: 100
- Quizzes: 50 (5*10)
- Total: 1,000

Conversion of total grades to Letter Grade		
	A=1000 - 910	A- = 909 - 880
B+ = 879 - 850	B = 849 - 820	B- = 819 - 780
C+ = 779 - 750	C = 749 - 720	C- =719 - 680
D+ = 679 - 650	D = 649 - 620	D+ = 679 - 650
	F < 580	

Score will not be curved. No make-up exams will be given. Reasonable exceptions may be granted in cases of illness which will require notification prior to the exam and must be followed up with an original signed note from a physician.

SCHEDULE OF TOPICS COVERED

Some chapters may require more or less time to cover than indicated on this schedule, so the actual chapter that I cover on given days is subject to changes depending on the rate of progress. Dates of exams and holidays are **not** flexible.

Week 1

Chapter 1 (08/29) Overview of genomics. Databases, databanks, and genome browsers

Week 2

Chapter 2 (09/03). DNA, RNA, protein, codon, central dogma, gene structure
Chapter 3 (09/05). Computer program overview for genomics: Linux, NCBI blast tools.

Week 3

Chapter 4 (09/10). Genome sequencing projects and genetic mapping.
Chapter 5 (09/12). Contents and organization of genomes, transposable elements
First homework assignment

Week 4

Chapter 6 (09/17). Nucleotide substitution: models and computation
Chapter 6 (09/19). Nucleotide substitution: models and computation
First homework assignment due

Week 5

Chapter 7 (09/24). DNA sequence and structure variations.
Chapter 8 (09/26). Comparative genomics

Week 6

Chapter 9 (10/01). First generation sequencing: Sanger dideoxy sequencing.
Chapter 10 (10/03). BAC by BAC DNA sequencing.
Second homework assignment

Week 7

Chapter 11 (10/08). Second generation sequencing: 454, Illumina, SOLiD, Ion Torrent
Chapter 12 (10/10). Third generation sequencing: PacBio SMRT and Nanopore ONT
Second homework assignment due

Week 8

Chapter 13 (10/15). Genome assembly
Midterm (10/17). Midterm

Week 9

Chapter 14 (10/22). Genome annotation
Chapter 15 (10/24). Resequencing mapping and GWAS

Week 10

Class tour (10/28). Tour to AGTC
Chapter 16 (10/31). Population genetics and genomics

Third homework assignment

Week 11

Chapter 17 (11/05). Gene and genome duplications

Chapter 18 (11/07). Paleogenomics and synthetic genomics

Third homework assignment due

Week 12

Chapter 19 (11/12). Functional genomics: Exomics

Chapter 19 (11/14). Functional genomics: Epigenomics

Week 13

Chapter 19 (11/19). Functional genomics: Transcriptomics

Week 14

Chapter 19 (11/26). Functional genomics: Phenomics

Student presentation (11/28). Term project presentation

Fourth homework assignment

Week 15

Student presentation1 (12/03). Term project presentation

Overview (12/05). Overviews

Fourth homework assignment due

Week 16

Term paper due on Wednesday, December 11, 2019

Final exam, Friday, December 13, 2019, 10:15am-12:15am.

SPECIAL CONSIDERATIONS FOR INDIVIDUALS WITH DISABILITIES

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. The SDS telephone number is 313-577-1851 or 313-202-4216 for videophone use. Once you have met with your disability specialist, I will be glad to meet with you privately during my office hours to discuss your accommodations. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University. You can learn more about the disability office at www.studentdisability.wayne.edu.

Please be aware that a delay in getting SDS accommodation letters for the current semester may hinder the availability or facilitation of those accommodations in a timely manner. Therefore, it is in your best interest to get your accommodation letters as early in the semester as possible.

RELIGIOUS HOLIDAY CONFLICTS

Students who have a conflict with any of the scheduled class or exam times due to religious reasons must notify Dr. Fan in writing by class time on or before Friday, September 20th, 2019. No make-up exams will be given unless he is notified in writing by this date.

ADD/DROP/WITHDRAW POLICY

Add requests will not be approved after the second week of class, i.e. Wednesday, September 11th, 2019. Beginning the third week of class, you are no longer allowed to drop classes, you must withdraw instead (<https://wayne.edu/registrar/dropping-a-class/>). Before withdrawing from a class, beware of the consequences. Make sure you've spoken with your instructor and advisor before making your decisions. Your instructor can provide valuable counsel on what it would take for you to successfully complete the course, and your advisor can review the university's course repeat policy to help you explore the benefits of completing the course.

It is your responsibility to request the withdrawal. Failure to do so will result in a failing grade. The withdrawal period for full-term classes ends at the end of the tenth week of the term. To view deadlines for a specific course, check the Class Detail panel of the class in the Class Schedule.

- Withdrawing does not cancel tuition or fees: You are still charged for courses from which you withdraw.
 - Withdrawing will affect you academically
- Withdrawing increases the cost of your education, lengthens your time to obtaining a degree, and creates additional periods of income loss while you make up lost credits.
- Withdrawals result in one of the following on your academic record, as determined by your instructor:
 - "WP" Withdrawal with a passing grade earned to date.
 - "WF" Withdrawal with a failing grade earned to date.
 - "WN" Withdrawal never attended or no graded work to date.
- Instructors can also deny the request, and you will still be registered for the course.

Further information on the withdraw policy can be found at <https://wayne.edu/registrar/withdrawing-from-a-course/>

UNEXPECTED UNIVERSITY CLOSURES.

If the University is officially closed on an exam day, the exam will be held on the next regularly scheduled class day. Closure of the University is announced by the following mechanisms:

1. WSU Homepage (www.wayne.edu)*
2. The University Newsline (313) 577-5345*
3. WSU Academica (www.a.wayne.edu)*
4. WDET-FM (Public Radio 101.9)
5. By other local radio and television stations

* Note: The information on closures and class cancellations is likely to be found at these locations before it is broadcast by local radio and television stations

OTHER

Please turn off cell phones and all other electronic communication devices during class and exams.

Any specific issue not covered by this syllabus will be resolved using University policies.

Disputes that cannot be resolved following the guidelines present in this syllabus will be resolved by following the guidelines of the University "Student Due Process".