

BIO5150/7150 Genomics Course Syllabus Fall Semester, 2018

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CLASS MEETING LOCATION

0317 State Hall

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 textbook:

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. 18th, 2018. The final exam will be non-cumulative and only cover the material presented after midterm. The final exam will be held on Tuesday, Dec. 18th, 2018, 8am-10am.

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 core of 10 points. **No make-ups** for quizzes.

TEAM PROJECT AND PRESENTATION

A team will be formed to conduct a genome 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 Friday, December 14, 2018.

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 | |
| B+ = 879 - 850 | B = 849 - 820 | B+ = 879 - 850 |
| C+ = 779 - 750 | C = 749 - 720 | C+ = 779 - 750 |
| 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 (08/30) Overview of genomics. Databases, databanks, and genome browsers

Week 2

Chapter 2 (09/04). DNA, RNA, protein, codon, central dogma, gene structure

Chapter 3 (09/06). Computer program overview for genomics: Genome Linux, NCBI blast tools.

Week 3

Chapter 4 (09/11). Genome sequencing projects and genetic mapping.

Chapter 5 (09/13). Contents and organization of genomes

First homework assignment

Week 4

Chapter 6 (09/18). Nucleotide substitution: models and computation

Chapter 6 (09/20). Nucleotide substitution: models and computation

First homework assignment due

Week 5

Chapter 7 (09/25). DNA sequence and structure variations.

Chapter 8 (09/27). Comparative genomics

Week 6

Chapter 9 (10/02). First generation sequencing: Sanger sequencing, automated sequencing, shotgun sequencing.

Chapter 10 (10/04). BAC by BAC DNA sequencing: BAC library construction, finger printing, FPC (finger printing contig), MTP (minimum tiling path).

Second homework assignment

Week 7

Chapter 11 (10/09). Second generation sequencing

Chapter 12 (10/11). Third generation sequencing

Second homework assignment due

Week 8

Chapter 13 (10/16). Genome assembly

Midterm (10/18). Midterm

Week 9

Chapter 14 (10/23). Genome annotation, resequence mapping and GWAS

Chapter 14 (10/25). Phylogenetics and phylogenomics

Week 10

Class tour (10/29). Tour to AGTC

Chapter 15 (11/01). Population genetics and genomics

Third homework assignment

Week 11

Chapter 16 (11/06). Gene and genome duplications, and transposable elements

Chapter 17 (11/08). Paleogenomics and synthetic genomics

Third homework assignment due

Week 12

Chapter 18 (11/13). Functional genomics

Chapter 18 (11/15). Functional genomics

Week 13

Chapter 18 (11/20). Functional genomics

Week 14

Chapter 19 (11/27). Genomics perspectives of domestication: animals and plants (crops)

Student presentation (11/29). Term project presentation

Fourth homework assignment

Week 15

Student presentation1 (12/04). Term project presentation

Overview (12/06). Overviews

Fourth homework assignment due

Week 16

Final exam, Tuesday, December 18, 2018, 8:00am-10:00am.

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 21nd, 2018. No make-up exams will be given unless he is notified in writing by this date.

ADD/DROP POLICY

Add requests will not be approved after the second week of class, i.e. Wednesday, September 12th, 2018. Drop requests must be approved before the fifth week of class (<http://reg.wayne.edu/students/information.php#dropping>). Beginning the fifth week of class students are no longer allowed to drop but must withdraw from classes. Students who sign up for a class, stop attending, and fail to withdraw will receive an F for the course. Students who withdraw from the course after the fifth week will be assigned one of the following three grades: WP (withdrew but was passing at the time), WF (withdrew but was failing at the time), WN (withdrew and never attended class or no graded work). An "I" grade earned by a student will automatically revert to "F" if the work is not completed within one calendar year. There are no exceptions. Further information on the grading policy can be found at <http://sdcl.wayne.edu/RegistrarWeb/Registrar/policies.htm>.

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".