PURDUE
UNIVERSITY

DEPARTMENTS OF BIOCHEMISTRY &
COMPUTER SCIENCE

BCHM 495 / CS490
(Computational Genomics) Syllabus
Fall, 2018

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Office hours: Immediately after lectures or by appointments

LECTURE TA:
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Office hours: Immediately after hand-on sessions

LECTURE TIME AND PLACE

WF, 3:30pm-5:20pm, LILY G428

COURSE DESCRIPTION

This course introduces advanced undergraduates and graduate students to basics of modern genomics and computational tools that will be used for screening. We will review the notion of gene, genome, transcriptome, and epigenome, and show how next generation sequencing technologies are utilized to measure these within cells.

LEARNING OUTCOMES

- Evaluate features of a genome (e.g. conservation, GC content, gene coding potential)
- Understand how data from next-generation sequencing experiments (e.g. RNA-seq) are generated and processed
- Analyze next-generation sequencing data (e.g. RNA-seq, ChIP-seq) from various experiments
- Integrate various genomics data to answer specific biological question related to genomics and gene regulation

Prerequisites

Some knowledge or experience with programing and basic molecular biology is welcomed. Necessary concepts from biology, statistics, and computational algorithms will be provided during the course.

TEXTBOOK

Bioinformatics and Functional Genomics 3rd Edition, Jonathan Pevsner, 2015

Bioinformatics Algorithms An Active Learning Approach, Phillip Compeau and Pavel Pevzner, 2014

http://www.ee.surrey.ac.uk/Teaching/Unix/

http://www.cyclismo.org/tutorial/R/

These textbooks are not required.

The following reference books are also on reserve at the Hicks Undergraduate Library and/or the Lilly Life Sciences library:

BLACKBOARD

The syllabus for the course, lecture notes, and grading keys for quizzes and exams will be available via the Purdue University Blackboard site at:
http://www.itap.purdue.edu/learning/tools/blackboard/

ASSESSMENT

Exams are cumulative.

The grading for this course will be as follows:

Midterm Exam 1	25 points
Final Exam	25 points
Homework	40 points
Class participation	10 points

The cutoff values for letter grades are as follows:

97-100	points	A+	77-79	points	C+
94-97	points	A	74-76	points	C
90-93	points	A-	70-73	points	C-
87-89	points	B+	67-69	points	D+
84-86	points	B	64-66	points	D
80-83	points	B-	60-63	points	D-
			00-60	points	F

Missing a quiz or exam will result in a grade of 0 being recorded unless documented justification for the absence is presented. Any request to be excused from a quiz or exam must include official documentation (doctor's note, request from academic advisor, etc) explaining why the exam was or will be missed. Makeup tests will be scheduled in consultation with the instructor.

If you have any disagreements with the way any of your quizzes or exams have been graded, please consult the grading key and then discuss them with the lecture TA. In the event this does not resolve your concerns, please take them up with the instructor.

Requests for re-grades must be submitted no later than the end of the second class period after the graded test or assignment has been returned.

LATE HOMEWORK/ASSINEMENT POLICY

Immediate 20% penalty for late submissions (even one minute), followed by 20% penalty for each day of delay.

EXTRA CREDIT

There will be no opportunity for extra credit.

OBTAINING EXTRA HELP

Dr. Kazemian will be available to answer your questions immediately after class or by appointment (arranged in class or by e-mail). Alternatively, you can submit questions by e-mail that can be answered in class or by return e-mail.

The lecture TA will hold office hours for at least X hours per week, and will be able to answer additional questions by appointment.

CLASS ATTENDANCE

In accordance with University policy, you are expected to attend every scheduled class. If you have a valid reason for missing class such as a University-sponsored activity, religious observances, illness, or family emergency, the instructor or TA will assist you in obtaining information and materials you may have missed. Students who skip class without a valid excuse should not expect the instructor or TA to supply class notes or provide special help. For the official university policy, see:
www.purdue.edu/odos/services/classabsence.php and
http://www.purdue.edu/studentregulations/regulations_procedures/classes.html

ACADEMIC MISCONDUCT

Academic misconduct of any kind will not be tolerated in any course offered by the Department of Biochemistry. Information on Purdue's policies with regard to academic misconduct can be found at
http://www.purdue.edu/studentregulations/student_conduct/regulations.html

Any incidence of academic misconduct will be reported to the Office of the Dean of Students. Academic misconduct may result in disciplinary sanctions including expulsion,

suspension, probated suspension, disciplinary probation, and/or educational sanctions. In addition, such misconduct will result in punitive grading such as:

- receiving a lower or failing grade on the assignment, or
- assessing a lower or failing grade for the course

Punitive grading decisions will be made after consultation with the Office of the Dean of Students. Please note reported incidences of academic misconduct go on record for reference by other instructors. Further, a record of academic misconduct is likely to influence how current/future situations are handled.

To provide you with an unambiguous definition of academic misconduct, the following text has been excerpted from "Academic Integrity: A Guide for Students", written by Stephen Akers, Ph.D., Executive Associate Dean of Students (1995, Revised 1999, 2003), and published by the Office of the Dean of Students in cooperation with Purdue Student Government, Schleman Hall of Student Services, Room 207, 475 Stadium Mall Drive West Lafayette, IN 47907-2050.

“Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, *Student Regulations*] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

More specifically, the following are a few examples of academic dishonesty which have been discovered at Purdue University.

- substituting on an exam for another student
- substituting in a course for another student
- paying someone else to write a paper and submitting it as one's own work
- giving or receiving answers by use of signals during an exam
- copying with or without the other person's knowledge during an exam
- doing class assignments for someone else
- plagiarizing published material, class assignments, or lab reports
- turning in a paper that has been purchased from a commercial research firm or obtained from the internet
- padding items of a bibliography
- obtaining an unauthorized copy of a test in advance of its scheduled administration
- using unauthorized notes during an exam
- collaborating with other students on assignments when it is not allowed
- obtaining a test from the exam site, completing and submitting it later
- altering answers on a scored test and submitting it for a regrade
- accessing and altering grade records
- stealing class assignments from other students and submitting them as one's own
- fabricating data
- destroying or stealing the work of other students

Plagiarism is a special kind of academic dishonesty in which one person steals another person's ideas or words and falsely presents them as the plagiarist's own product. This is most likely to occur in the following ways:

- using the exact language of someone else without the use of quotation marks and without giving proper credit to the author
- presenting the sequence of ideas or arranging the material of someone else even though such is expressed in one's own words, without giving appropriate acknowledgment
- submitting a document written by someone else but representing it as one's own"

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

Purdue's Honor Pledge was developed by students to advance a supportive environment that promotes academic integrity and excellence. It is intended that this pledge inspires Boilermakers of all generations to stay "on track" to themselves and their University. "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

NOTICE OF COPYRIGHT PROTECTION OF COURSE MATERIALS

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

EMERGENCY PREPAREDNESS

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. To get information about changes in this course consult the class Blackboard site or e-mail or phone the instructor.

ON-LINE COURSE EVALUATIONS

During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor(s). To this end, Purdue has transitioned to online course evaluations. On Monday of the fifteenth week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

NON-DISCRIMINATION POLICY

Purdue University's non-discrimination policy will be upheld in this classroom. Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University views, evaluates, and treats all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

In this course, each voice in the classroom has something of value to contribute. Please take care to respect the different experiences, beliefs and values expressed by students and staff involved in this course. We support Purdue's commitment to diversity, and welcome individuals of all ages, backgrounds, citizenships, disability, sex, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences

For more information, see http://www.purdue.edu/purdue/ea_eou_statement.html.

MENTAL HEALTH

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 or http://www.purdue.edu/caps/ after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

ACCESSIBILITY AND ACCOMODATIONS

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

DISCLAIMER

This syllabus is subject to change.

TENTATIVE LECTURE SCHEDULE

Week	Topics (Lecture)	Hands-on Lab	NOTES
1	Introduction	Unix commands and shell programs	
2	Genomes and features	UCSC genome browser	
3	Gene prediction tools and methods	Identifying new genes (e.g. from a plasmid)	
4	Sequence alignment and mapping techniques	BLAST	
5	Genome sequencing technologies	File formats (FASTQ, BED) and Quality Control	
6	Genome assembly techniques	De-novo assembly (e.g. wide-seq data)	
7	Mid-term		
8	Transcriptome and cells	RNA-seq data analysis	
9	Transcriptomic data analysis	Finding differentially expressed genes (DEGs)	
10	Biological Networks and Pathway	Pathway analysis of DEGs	
11	Epigenetics: techniques and applications	ChIP-seq data analysis and visualization	
12	Gene Regulatory networks	Motif finding using meme suite	
13	Genetic variation and diseases	SNP calling	
14	Genomic structural variations	Structural variation identification	
15	Biological databases	information integration from SRA	