Biochemistry (BCH) 709

Introduction to Bioinformatics Fall 2019 (Section 1001)

Fall, 2020

Course Information

Instructor Information

Instructor: Dr. Won C. Yim
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Office hours: 10:30 – noon, Thursday or by appointment.
To make an appointment, please e-mail Dr. Yim.

Course Description

As contemporary biologists, we have entered an age where the use of computers in our daily work has become all but essential. The manipulation and analysis of DNA, RNA, and protein data by electronic means has become a routine task. Further, the amount of DNA, RNA and protein sequence data we are putting into databases every day is expanding at a geometric rate, and with coming advances in sequencing technology, this rate is only expected to increase. With all this new data, analysis by individual humans is simply not possible. Thus, in the past 15 years, computational biology has emerged as a field concerned with storage, manipulation, and extraction of valuable information from all this new data. However, because computational biology is an emerging field, organized courses are generally saved for higher-level study, and often are not required parts of an undergraduate curriculum. We seek to fill this void in education and create a course that will introduce students to bioinformatics at an earlier point in their education. This knowledge will prove to be not simply useful, but essential, for any student considering a degree in any area of biology and medical science.

Short description: In-depth knowledge for bioinformatics with the extensive use of terminal, investigation and problem-solving skill, improving bioinformatics understanding and computational analyze skills within the molecular biosciences.

Course Pre/Co-requisites

Course Prerequisite: BCH 400 or equivalent; two semesters of general biology; BCH 413, 613 or consent of the instructor as pre- or co-requisites. It is **STRONGLY** recommended that students complete an undergraduate **Molecular Biology course** (e.g., BCH/BIO 405) prior to enrolling in BCH 709.

Course Prerequisite or Corequisite: None.

Course Corequisite: None.

Required Texts/Course Materials

List of required course materials for reading, in-class work, writing, homework, viewing, and listening, including calculators, specialized materials or equipment, and computer software.

- Laptop (Mac / Windows OS)
- Webcam
- Microphone
- Keyboard
- Internet connection
- Zoom
- Chrome / Edge / Safari / Explorer
- SLACK

Class Procedures/Structures

Alternative HyFlex: This course will be delivered in the HyFlex modality. Synchronous class meetings will take place with students alternating in-person and remote (Zoom) participation. The course will be offered through Zoom participation at MW 9:00 – 10:10 AM at FA234. However, if all student wants to do completely online instruction, the course will be delivered through YouTube via WebCampus.

General meeting: General meeting will be offered through SLACK and need to be arranged.

Student Learning Outcomes

- **Overall SLO**: This course will be taught with the extensive use of terminal, investigation and problem-solving. Students will be using computers in most sessions to analyze data, write/run code, troubleshoot, summaries and discuss.
- **SLO1:** Through terminal, students will demonstrate the ability to design experimental strategies using state-of-the-art methods/approaches to address biological questions.
- **SLO2:** Through computational work and in-class discussions, students will demonstrate a working understanding of advanced topics in bioinformatics.
- **SLO3:** Through written and oral summaries, students will demonstrate the ability to evaluate the salient points of primary research articles critically.
- **SLO4:** Students will demonstrate the ability to summarize and effectively lead discussions of primary research literature.
- **SLO5:** Students will demonstrate the ability to analyze RNASeq and related experiment using state-of-the-art methods/approaches to address biological questions.

Course Requirements

1. Students are required to attend all scheduled classes (both Monday and Wednesday) or required to watch online recorded material until class scheduled Friday noon.

2. Complete assignments (including in bioinformatics exercises) associated with course objectives.

3. Prepare a Term paper, 4 – 5 pages written “mini-review” of bioinformatics from a list provided by the instructor. Our review will summarize the state-of-the-art in a particular topic area while

citing both seminal historical and modern, cutting edge references that have defined major advances in the field.

4. Participate in the exam. There will be one midterm and one final exam. Both will be written and will use the computer. Each will test your knowledge of material for one half of the course (i.e., the midterm will test the first half of the semester, and the final will test the second half). In addition, the final exam will include a written analysis of bioinformatics. Both exams will have three days period to complete. More information can be found in the WebCampus course section

Grading Criteria, Scale, and Standards

Points will be distributed as follows:

Class Participation	160
Homework Assignments	350
Discussion	100
Term paper	100
Midterm exam	150
Final exam	200
Total	1000

Within each category above, the grading scale will be:

Rating:	**Percentile:**	**Letter grade:**
Excellent	**90-100%**	**A**
Good (acceptable for graduate work)	**80-89%**	**B**
Fair (unacceptable for graduate work)	**70-79%**	**C**
Poor	**60-69%**	**D**
Failing	**< 60%**	**F**

Late Work / Make-up Exams / Participation Policies

A penalty of 10 % per day will be imposed on a pro rata basis for any late work or attendance. *You will be graded on the quality of the assignments listed below and the quality and quantity of your participation in class discussions. Final grades may be adjusted at the discretion of the instructor.*

No make-up exams allowed. *If you cannot finish exam due to circumstances beyond your control, the instructor kindly requests the professional courtesy of being notified of your absence ahead of time.* ***Email only***

Class participation points will be deducted for each unexcused absence (5 points per class missed without informing the instructor before the class meets)*. For a full description of UNR's class attendance policies, please see: "https://www.unr.edu/administrative-manual/3000-3999-students/3020-class-absence-policy."* ***Email only***

Attendance. *You are required to attend lecture/online sessions. If you cannot attend due to circumstances beyond your control, the instructor kindly requests the professional courtesy of being notified of your absence ahead of time. (Dr's notes etcs).* ***Email only***

Plagiarism Policy

Plagiarism (copying all or part of someone else's work and passing it off as your own) is a serious form of academic misconduct and will not be tolerated in this class. Plagiarism is defined as submitting the language, ideas, thoughts or work of another as one's own; or assisting in the act of plagiarism by allowing one's work to be used in this fashion. "The work of another" does not just mean whole papers or articles copied from another source. It includes any information, ideas, sentences, or phrases that came from somewhere other than your own head (i.e. books, articles, internet sites, videos, documents, lecture notes or handouts from other courses, and any other sources used in your paper). These must be properly acknowledged by providing references either in the text or in a footnote, along with a bibliography giving the complete publication information for all sources used in your paper. Even if you paraphrase someone else's ideas and do not quote them directly, you still must acknowledge your source. Citations should also be given for little known facts and statistics. ***Ignorance is not an excuse for plagiarism. If you are not sure whether you need to provide a source for a piece of information or how to cite a source, ask the course instructor.***

Course Calendar or Topics Outline

Week	Tuesday	Thursday
Week1	Intro to Bioinformatics	Linux Environment and command line
Week2	Linux Environment and command line	Linux Environment and Cloud
Week3	Compile & Software Installations	GitHub and server
Week4	Sequencing methods and strategies	RNA-Seq
Week5	Transcriptome assembly	Transcriptome algorithms

Week6	Transcriptome assembly II	DEG analysis
Week7	Introduction of R & R plotting (Tong Zhou PhD)	Database
Week8	DESeq2 / EdgeR	Special topics (Tong Zhou PhD)
Week9	Gene family analysis and phylogenetics (David Alvarez-Ponce, PhD)	Midterm exam: Transcriptome & Database
Week10	Genome assembly	Genome assembly
Week11	Genome assembly	How to annotate genomes
Week12	Genome assembly and annotation	Genome structure
Week13	DEG analysis	Transcriptome analysis
Week14	Variant analysis	Thanksgiving
Week15	Enrichment analysis	Presentation
Week16	Final exam	

Literature and web resources:

Textbooks (ebooks):

- Introduction to Bioinformatics (3rd Edition)
- Learn Linux Shell Scripting - Fundamentals of Bash 4.4
- Effective awk Programming, 3rd Edition
- Bioinformatics with Python Cookbook - Second Edition
- Basic Applied Bioinformatics
- Ubuntu Unleashed 2019 Edition: Covering 18.04, 18.10, 19.04, 13/e
- Unix and Perl: Keith Bradnam & Ian Korf
- Other bioinformatics books from knovel
- Other bioinformatics books from Oreilly
- Command line website
- Plant Genomics Lab

Zoom & SLACK Etiquette or Netiquette Expectations

Participation During Zoom Meetings

Portions of our class will take place synchronously via Zoom. During these meetings, students are expected to pay attention, participate in small groups, and engage with the material. If possible, find a quiet space without interruptions/background noise.

Video: Your video should be on during class—if you aren't able, please email me ahead of time. Make sure your face can be seen clearly. Note that your instructor and classmates will be able to see you, and prepare accordingly (i.e., be fully dressed, avoid lying down in bed, etc.). Note that UNR has loaded campus-themed virtual backgrounds into all Zoom accounts that can be used to hide your surroundings, if desired.

Audio: Your audio should be on when you join class, and you should immediately mute yourself upon entering the session (if you are not already muted). You can unmute yourself when you want to participate. Turning on your microphone is a good way to indicate you want to add to the discussion, but you can also use the hand-raising symbol. Your audio should be on the whole time you're in your breakout room.

Chat Function: Please use the chat tool to ask questions or contribute ideas, but stay on topic to the information being presented.

Discussion and video meeting through SLACK

Any class related questions are allowed through SLACK. You are required to chat with instructor in class channel only. **Direct message will not be allowed and will be ignored. Assignments and exam related questions are not allowed through SLACK.**

University Policies

Statement on COVID-19 Policies

Training

Students must complete and follow all guidelines as stated in the *Student COVID-19 Training* modules, or any other trainings or directives provided by the University.

Face Coverings

In response to COVID-19, and in alignment with State of Nevada Governor Executive Orders, Roadmap to Recovery for Nevada plans, Nevada System of Higher Education directives, the University of Nevada President directives, and local, state, and national health official guidelines face coverings are required at all times while on campus, except when alone in a private office. This includes the classroom, laboratory, studio, creative space, or any type of in-person instructional activity, and public spaces.

A "face covering" is defined as a "covering that fully covers a person's nose and mouth, including without limitation, cloth face mask, surgical mask, towels, scarves, and bandanas" (State of Nevada Emergency Directive 024).

Students that cannot wear a face covering due to a medical condition or disability, or who are unable to remove a mask without assistance may seek an accommodation through the Disability Resource Center.

Social Distancing

Face coverings are not a substitute for social distancing. Students shall observe current social distancing guidelines where possible in accordance with the Phase we are in while in the classroom, laboratory, studio, creative space (hereafter referred to as instructional space) setting and in public spaces. Students should avoid congregating around instructional space entrances before or after class sessions. If the instructional space has designated entrance and exit doors students are required to use them. Students should exit the instructional space immediately after the end of instruction to help ensure social distancing and allow for the persons attending the next scheduled class session to enter.

Disinfecting Your Learning Space

Disinfecting supplies are provided for you to disinfect your learning space. You may also use your own disinfecting supplies.

COVID-19, COVID-19 Like Symptoms, and Contact with Someone Testing Positive for COVID-19

Students must conduct daily health checks in accordance with CDC guidelines. Students testing positive for COVID 19, exhibiting COVID 19 symptoms or who have been in direct contact with someone testing positive for COVID 19 will not be allowed to attend in-person instructional activities and must leave the venue immediately. Students should contact the Student Health Center or their health care provider to receive care and who can provide the latest direction on quarantine and self-isolation. Contact your instructor immediately to make instructional and learning arrangements.

Tracking In-Class attendance

In person attendance will be fluid and difficult to track for classes taught through hyflex or multimodal instructional delivery. If a student in your class tests positive for COVID 19, an awareness of which students are present and in which seat they are sitting will be very important for contact tracing. Therefore, we suggest that instructors use their cell phones to photograph or video record classroom participants at the beginning of each class period. This will provide a record of in class attendance and student seating positioning. Instructors choosing this option, will be required to inform students during the first day of class and in their syllabus that in class participants will be photographed or videoed each period only for use for contact tracing purposes in the case one of their classmates test positive for COVID 19.

Laboratory, Studio, and Creative Space Settings

You will be provided specific instructions and procedures by your instructor for art studios, recording studios, digital media labs, testing centers, observation labs, podcasting studios, dance studios, clinical centers, research labs, physical science labs, etc. as necessary.

Failure to Comply with Policy (including as outlined in this Syllabus) or Directives of a University Employee

In accordance with section 6,502 of the University Administrative Manual, a student may receive academic and disciplinary sanctions for failure to comply with policy, including this syllabus, for failure to comply with the directions of a University Official, for disruptive behavior in the classroom, or any other prohibited action. “Disruptive behavior" is defined in part as behavior,

including but not limited to failure to follow course, laboratory or safety rules, or endangering the health of others. A student may be dropped from class at any time for misconduct or disruptive behavior in the classroom upon recommendation of the instructor and with approval of the college dean. A student may also receive disciplinary sanctions through the Office of Student Conduct for misconduct or disruptive behavior, including endangering the health of others, in the classroom. The student shall not receive a refund for course fees or tuition.

Statement on Academic Dishonesty

"The University Academic Standards Policy defines academic dishonesty, and mandates specific sanctions for violations. See the University Academic Standards policy: UAM 6,502."

Statement of Disability Services

Use either the traditional or online statement, in addition to the last sentence regarding third party materials.

For Traditional and Seated Classrooms:

"Any student with a disability needing academic adjustments or accommodations is requested to speak with me or the Disability Resource Center (Pennington Achievement Center Suite 230) as soon as possible to arrange for appropriate accommodations."

For Online Courses:

"If you are a student who would normally seek accommodations in a traditional classroom, please contact me as soon as possible. You may also contact the Disability Resource Center for services for online courses by emailing drc@unr.edu or calling 775-784-6000. Academic accommodations for online courses may be different than those for seated classrooms; it is important that you contact us as soon as possible to discuss services. The University of Nevada, Reno supports equal access for students with disabilities. For more information, visit the Disability Resource Center."

This course may leverage 3rd party web/multimedia content, if you experience any issues accessing this content, please notify your instructor.

Statement on Audio and Video Recording

Student-created Recordings

"Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded."

Instructor-created Recordings

Class sessions may be audio-visually recorded for students in the class to review and for enrolled students who are unable to attend live to view. Students who participate with their camera on or who use a profile image are consenting to have their video or image recorded. If you do not consent to have your profile or video image recorded, keep your camera off and do not use a profile image. Students who un-mute during class and participate orally are consenting to have their voices recorded. If you do not consent to have your voice recorded during class, keep your mute button activated and only communicate by using the "chat" feature, which allows you to type questions and comments live.

Statement on Maintaining a Safe Learning and Work Environment

The University of Nevada, Reno is committed to providing a safe learning and work environment for all. If you believe you have experienced discrimination, sexual harassment, sexual assault, domestic/dating violence, or stalking, whether on or off campus, or need information related to immigration concerns, please contact the University's Equal Opportunity & Title IX office at 775-784-1547. Resources and interim measures are available to assist you. For more information, please visit the Equal Opportunity and Title IX page**.**

In addition to the required information listed above, it is strongly recommended that the syllabus include:

- Methods for communicating with students outside the classroom regarding matters such as class cancellations, meeting times, or room changes
- More detail about what constitutes academic dishonesty, with a concrete list or examples of "dos and don'ts" in the context of the class
- **Statement for Academic Success Services**: "Your student fees cover usage of the Math Center (775) 784-4433, Tutoring Center (775) 784-6801, and University Writing Center (775) 784-6030. These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student."