BIOL/BINF 5352: Introduction to Bioinformatics II
Spring 2023
Lectures: Monday, 3:30 pm to 5:30 pm BE300 or Blackboard collaborate:
Labs: Wednesday, 3:00 pm to 5:50 pm BE302

Unofficial Course Description:

This is a continuation of BINF 5351: Bioinformatics I, offered last semester. In the previous course, you studied the basics of sequence comparisons, multiple sequence alignment, pattern recognition, and tree construction on a limited number of identified sequences. In the current course, we will expand the application of these principles to real world data and apply them within the context of the cell and Cell Biology. Topics include genome assembly and finishing, identification and annotation of protein genes and metabolic pathways, determination of mRNA and protein expression, and advanced RNA analysis and folding. As time permits, we will also investigate current, specialized topics of bioinformatics in research and industry. Throughout the semester we will also be modeling the requirements for independent work in the bioinformatics field: reading and understanding current research presented in the primary literature.

Student Learning Objectives:

The Successful student will be able to:

1). **Read, understand, and apply bioinformatic data and tools gleaned from primary literature.**
2). **Understand and apply bioinformatic sequence analysis in the context of the whole cell.**
3). **Demonstrate practical experience in the implementation of specialized bioinformatics software for genome scale analysis and higher.**
4). **Synthesize and cogently present on scientific topics and systems.**

Professors:

Dr. Sourav Roy is a computational biologist with a research background in genetics, genomics, bioinformatics, and molecular biology. His research has involved the utilization of diverse in-silico, in-vitro, and in-vivo methodologies to understand the regulation of gene expression. His current research projects include regulatory genomic studies of vector mosquitoes; evolutionary and comparative genomic studies of molecular pathways in insect vectors; the role of miRNAs in various organisms; and investigation of oxidative stress induced cellular survival pathways in colorectal cancer health disparities – all of which involve analysis and validation of high throughput and next-generation sequencing data using bioinformatics tools and molecular techniques.

Dr. Elizabeth Walsh is the Director of the Ecology and Evolutionary Biology program. Her work focuses on ecology and evolutionary biology of freshwater invertebrates, especially phylogenetics, molecular detection of cryptic species, RNASeq, and environmental sequencing. She has been teaching Bioinformatics 1, and occasionally Bioinformatics 2, since the inception of the program.

Teaching Assistant:

The Teaching Assistant for this semester is TBD, a student in Computational Science. He/she will be responsible for the laboratories and homework assignments. His office hours will be posted separately from this syllabus in BE 302. He/she can also be reached by email at:

For issues with the Bioinformatics computer systems and software, you may also seek help from Dr.

Khodeza Begum, systems analyst for the Bioinformatics program and a faculty member in the Department of Mathematical Sciences. Her email is kbegum@utep.edu

If this is Monday, where am I supposed to be!?

Monday is nominally the Lecture portion of the class, running from 3:30 pm to 5:30 pm. Wednesday is usually a laboratory meeting, running from 3:00 pm to 5:50 pm. These classes are will be held Online through Blackboard. The lecture/laboratory designations of a class, however, can vary depending on the schedules of the professors and guest lecturer/laboratory director, and in some circumstances, we may trade class and laboratory times. The table below gives the current schedule, but this will likely change!!

Please check your email and the Blackboard course site regularly for updates!!

Do I need to buy a book?

At this level of course, books are primarily for reference use. The textbook from Bioinformatics part I, **Bioinformatics** by David Mount, will still be useful, so don't give it away. In addition, you will probably want access to an undergraduate level biochemistry or molecular biology text, but you may choose which text you use. In particular, we would suggest that you check with your classmates or a friendly professor to see if they have a book they could loan (or give) you for the semester. Finally, you will find use for a programming guide on your programming language of choice, and a basic guide on mysql.

Blackboard course site

The course will be coordinated through a **Blackboard** course site, available through your logon to "my.utep.edu". This site is the primary source of lectures and labs (Blackboard collaborate) course readings and other handouts (including a copy of this syllabus), course calendar, and some supplemental web sites and notes for lectures. There are also discussion boards for after class interaction as well as quizzes and other assessments. All course grades will also be presented through Blackboard. The site is reasonably self-explanatory, however if questions arise, please talk to the instructor or TA earlier rather than later!!!

What Computer will I use?

The short answer is essentially whichever one you want to! Almost all of the software we use in this portion of the course is open source and/or publicly available and able to be compiled on most systems. The scale of the computational problems in this semester will be of a scope that is best handled by **command line interfaces** (e.g., unix, linux, or even DOS), customized programs, or scripts for parsing output. All instructors and TAs use Python and R. Regardless, you may use the language of your choice. You will also want to be able to query items stored in a mySQL database – but this, too, is open source, and all components are also available on any major platform.

All computational labs may be done online, on the Linux and Unix platform. In addition to times when you have direct access to these machines, they are also accessible via the Internet through SSH. That being said, you will find that that most bioinformaticians perform much of their day-to-day work on a personal laptop! If you have a laptop computer, I strongly recommend that you practice using your personal computer in and for the course. Even when your complete program may require a mainframe, you can often accomplish much of the setup and debugging – and analysis! -- on your personal machine.

Class Components and Grades:

The primary goal of this course is to develop and practice approaches and skills that would apply to a full-scale bioinformatics project. As such, the grading for the course will emphasize the practical application of acquired skills. Specific grade components will include Homework, a stand-alone White Paper, Laboratory Assignments and Final-Exam.

Grade Point Distribution:

Homework Assignments 30%

Homework assignments are weekly writing, research, or programming assignments to be done out- side of class and turned in according to individual deadlines. In some cases, these assignments will overlap with the laboratory portion of the course.

White Paper on Research Project 10%

A "White Paper" is a one to two-page summary of a proposed Research Project (topic of your choice). Full formatting details will be available on Blackboard, under "Handouts." Grading will be by the "White Paper Rubric" found on Blackboard. Assignments include White paper hypothesis, due April 19, a draft version of the white paper, due April 26. The final draft of the document is due May 3.

Final Examination 30%

The final examination will be used for assessment of understanding and application of basic concepts and applications. The actual format is flexible, and the exam will be online on Monday, May 10.

Computer and Wet Lab Exercises and Follow-up 30%.

The Wednesday afternoon class will usually be the time for laboratory exercises. These exercises will be under the guidance of the laboratory teaching assistant, TBA, and the laboratories used will vary as needed. Computer laboratory exercises will be held online.

Because of the computational time needed for many of the computer exercises, it is expected that you may need to complete the computer laboratories and write-ups outside of the scheduled lab hours. "Wet" laboratory locations will be scheduled as possible when, and if, in-person meetings are deemed safe by the University.

COURSE POLICIES:

Class participation:

You are expected to attend the in-person or synchronous sessions, be prepared to answer questions about the assigned readings or other materials.

E-mail and Blackboard:

You are required to provide the teaching team with a UTEP e-mail address and check your UTEP e-mail and Blackboard daily. We will use your UTEP e-mail to contact you and you will use your UTEP e-mail to contact us as well. *Do not use Blackboard for e-mail.*

Dropping the course:

Students may drop the class and receive a W (withdrawal) on their transcript prior to March 30th, 2023. You must consult the instructor prior to dropping. Due to the University's six-drop rule, dropping the course may not be in your best interest. After March 30th, a drop will result in an F on your transcript. Receiving either a W or an F in any course may prevent you from meeting the satisfactory Academic Progress requirements necessary to receive financial aid.

Student Conduct:

Each student is responsible for notice of and compliance with the provisions of the Regents' Rules and Regulations, available at http://www.utsystem.edu/bor/rules/homepage.htm. All students are expected to behave as courteous, responsible adults. We will have frequent discussions and students are expected to tolerate and respect the opinions of others.

Cellular and electronic devices:

Cell phones and other electronic and recording devices must be turned off during class time to minimize classroom disruptions and protect the integrity of test-taking situations. This means you cannot make calls, send text messages, or use social media during class. You may use your laptop or tablet to take notes in class, but this privilege will be revoked if the devices are used inappropriately.

Students who fail to follow this rule may incur disciplinary action up to and including dismissal from the class and upon repeated offenses, the course.

Final Exam:

[From the online Schedule of Classes] "Exemption from final examination may not be given. Final examinations are scheduled to be three hours in length and take place during the final examination period. It is the policy of the university not to administer a second final examination in the course. It is also university policy that students shall not have more than two final examinations in a single day. In the unlikely event that the examination schedule results in a student having three final examinations on a single day, the faculty member upon the request of the student shall reschedule the second of that student's three examinations."

Academic Integrity:

All graded assignments must be entirely the work of the *individual* student. *"Plagiarism" means the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the unacknowledged submission or incorporation of it in one's own academic work offered for credit, or using work in a paper or assignment for which the student had received credit in another course without direct permission of all involved instructors.* (from the Regents' Rules and Regulations) Plagiarism is a serious violation of university policy and will not be tolerated. All cases of suspected plagiarism will be reported to the Dean of Students for further review.

Disability accommodations:

If you have or suspect you might have a disability and need an accommodation you should contact the Center for Accommodations and Support Services (CASS) at 747-5148 or at cass@utep.edu or go to Room 106 Union East Building. Students are responsible for providing any CASS accommodation letters and instructions.

Campus Carry:

Persons holding a Concealed Handgun License can lawfully carry their handgun into a UTEP classroom as long as the gun remains concealed. Open carry remains prohibited on campus. In other words, none of us should see (or be able to tell that there is) a gun at UTEP. Call the University Police at 747-5611 or dial 911 if you see any individual on campus with a handgun or other type of weapon. For more information on campus carry, see [http://sa.utep.edu/campuscarry/]; for more information on overall campus safety, see [http://admin.utep.edu/emergency].

Military Statement:

If you are a military student with the potential of being called to military service and /or training during the course of the semester, you are encouraged to contact us no later than January 27.

Date	Day	Lect/Lab	Topic	Instructor
1/18/23	W	Lect 01	Introductions, Syllabus, Review	SR
1/23/23	M	Lect 02	Sequencing, Assembly, & Finishing	JM
1/25/23	W	Lab 02	Wet Lab: eDNA	EW
1/30/23	M	Lect 03	Environmental Sequencing	EW
2/1/23	W	Lab 03	Intro to qiime	TA-EW
2/6/23	M	Lect 04	Gene Calling: de novo & empirical	SBA (Guest)
2/8/23	W	Lab 04	Gene calling with Glimmer and Aragorn	TA-SBA
2/13/23	M	Lect 05	Genome Comparison	EW
2/15/23	W	Lab 05	OrthoVenn, MUMmer, SynMap 3D, and Gene structure display server	TA-EW
2/20/23	M	Lect 06	Annotation I	JM
2/22/21	W	Lab 06	Gene ontology with GO analysis	TA-JM
2/27/23	M	Lect 07	Annotation II	JM
3/1/23	W	Lab 07	Blastp against Swissprot database then reverse blast.	TA-SR
3/6/23	M	Lect 08	SNPs	SR
3/8/23	W	Lab 08	Exploring SNP Data from NCBI's 1000 Genomes Viewer. Ancestry analysis using structure software	TA-SR
3/13/23	M	Spring break	no class	
3/15/23	W	Spring break	no class	
3/20/23	M	Lect 09	RNA Hybridization and MicroArray	SR
3/22/23	W	Lab 09	Microarray Data download and Clustering (in R): Multi-Experiment Viewer Analyze normalized gene expression data from GEO database using R Analysis of real microarray data set	TA-SR
3/27/23	M	Lect 10	Analysis: MicroArray II/RNA-seq	SR
3/29/23	W	Lab 10	Analyzing differentially expressed genes from NCBI-GEO2R; Statistical inference of genes (T-test and Anova)	TA-SR
4/3/23	M	Lect 11	Regulatory genomics and motif discovery	SR
4/5/23	W	Lab 11	Motif discovery: MEME	TA-SR
4/10/23	M	Lect 12	Epigenomics	SR
4/12/23	W	Lab 12	Epigenomics Lab	TA-SR
4/17/23	M	Lect 13	Proteomics - MS/MS	IA (Guest)
4/19/23	W	Lab 13	MS/MS Data Analysis	TA
4/24/23	M	Lect 14	Protein folding and ligand binding	SR
4/26/23	W	Lab 14	TBA	TA-EW
5/1/23	M	Lect 15	RNA folding	EW
5/3/23 5/8/23	W M	Lab 15 Final Exam	RNA folding Lab BE 300	TA-EW