BB485/585 - Applied Bioinformatics – 3 credits

Learner Outcomes –As a result of taking this course the students will:
• Correctly utilize the specialized language of bioinformatics and computational biology.
• Analyze data using bioinformatics to understand eukaryotic gene regulation.
• Choose appropriate methods and research questions for bioinformatics investigations.
• Appropriately use command-line software in a unix environment to answer specific bioinformatics questions.
• Appropriately use modules and methods from Biopython to answer specific bioinformatics questions.
• Apply modern methods of bioinformatics to medicine and biology.

Pre-requisites and Co-requisites
BI314 or equivalent , or by instructor approval.

Professor
David Hendrix

Teaching Assistant
TBD

Text:
We will use the text "Applied Bioinformatics of Nucleic Acid Sequences" here:
http://hendrixlab.cgrb.oregonstate.edu/teaching/ab/AB.pdf
The text will be updated throughout the course.
Class Lecture slides provided by Professor on canvas.

Grading:

Undergrads taking 400 level version:
Homework, 5 problem sets (50%: 5 sets 10% each for weeks 2,4,6,8,10)
Project write-ups (10%, close to weekly)
Mid Term Exam 50pts (20%)
Final Exam 100pts (20%)

Graduate Students taking 500 level version:
Graduate students will have additional, more advanced homework and/or test questions, as well as a Term Project consisting of either a **research proposal** or **Biopython implementation** in which ideas from the course are further synthesized and learned at a deeper level.

Homework, 5 problem sets (40%: 5 sets 8% each for weeks 2,4,6,8,10)
Project write-ups (10%, close to weekly)
Mid Term Exam 50pts (20%)
Final Exam 100pts (20%)
Term Project (10%)

Syllabus:

Week 1: Introduction
Reading: Chapter 1: Introduction to Biological Sequences
Key concepts: Biological Sequences, Unix, and Biopython

Biopython modules: Bio.Seq, SeqIO, Entrez

Week 2: Sequence Motifs
Reading: Chapter 2: Sequence Motifs
Key concepts: Sequence motifs, Consensus sequences, Weight Matrices, Motif Finding, software: MEME, FIMO
Biopython module: motifs

Week 3: Sequence Alignment
Reading: Chapter 3: Sequence Alignment
Key concepts: Alignment algorithms, Substitution Matrices, BLAST
Biopython module: Bio.SubsMat

Week 4: Molecular Evolution and Phylogenetics
Reading: Chapter 4: Molecular Evolution and Phylogenetics
Key concepts: Evolutionary Models, Phylogenetic Tree building,
Biopython module: Phylo

Week 5: Genomics
Reading: Chapter 5: Genomics
Key concepts: Fundamentals of genome annotations, GFF, Bed files, Bedgraph, Genome Browsers

Week 6: Transcriptomics
Reading: Chapter 6: Transcriptomics
Key concepts: Transcription, Expression, RNA-Seq

Week 7: Noncoding RNAs
Reading: Chapter 7: Noncoding RNAs
Key concepts: RNA interactions, Structure Prediction, software: triplexator, RNAfold

Week 8: Proteins
Reading Chapter 8: Proteins
Key concepts: Protein Domains (PFAM), Secondary Structure Prediction, HMMs, software: HMMer

Week 9: Gene Regulation
Reading: Chapter 9: Gene Regulation
Key concepts: Transcription factors, ChIP-Seq, microRNAs, microRNA target prediction, TargetScan, software: bowtie, Macs, MEME

Week 10: Catch-up and Review

Final Exam

Learner Expectations

1. Attend lectures (exams will be based on subjects covered in lecture)
2. Prepare for lectures by reviewing lecture notes and readings BEFORE lecture.
3. Attend office hours if there is difficulty in understanding concepts or problems.
4. Talking, eating, chewing gum noisily, using cell phones and other distracting activities are inconsiderate to fellow students and the lecturer; be considerate.

Statement Regarding Students with Disabilities: Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098 (tracy.bentley@oregonstate.edu).

Statement of Expectations for Student conduct: The Student Conduct & Community Standards office has generated a set of standards & expectations for student behavior. This information is at http://oregonstate.edu/admin/stucon/index.htm>http://oregonstate.edu/admin/stucon/index.htm.

Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations. Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- cheating – use or attempted use of unauthorized materials, information or study aids
- fabrication – falsification or invention of any information
- assisting – helping another commit an act of academic dishonesty
- tampering – altering or interfering with evaluation instruments and documents
- plagiarism – representing the words or ideas of another person as one's own

Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action.

"The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student's freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office."