

Applied Bioinformatics: BMEN6387/BIOL5376

Fall 2016

**Lecture TR 5:30 – 6:45 PM
JSOM1.202**

INSTRUCTORS: Stephen Levene
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OFFICE HOURS: Dr. Levene – F 8:30-10:30 AM (Location TBA) and by appointment
Dr. Xuan – by appointment

PREREQUISITES: Two semesters of calculus AND one semester introductory statistics OR instructor's consent

CATALOG DESCRIPTION: A graduate-level course that presents a practical approach to quantitative and statistical analysis of biological sequence and structural information. Topics may include, but are not limited to, genomic information content, data searches and sequence alignment, mutations and distance-based phylogenetic analysis, genomics and gene recognition, polymorphisms and forensic applications, nucleic-acid and protein array analysis, structure prediction of biological macromolecules.

ADDITIONAL INFORMATION: This is a core course in Bioengineering that can also satisfy the bioinformatics core requirement for students in the Biological SciencesMS in Biotechnology program. It is intended to be taken in the fall semester of the first year of their two-year program. Students from Ph.D., Masters, and B.S programs in Molecular & Cell Biology, Engineering, Computer Science, and Mathematics typically enroll in the course. The course introduces state-of-the-art statistical and quantitative techniques of biological sequence analysis including pairwise and multiple sequence alignment, phylogenetic analysis, protein structure and fold prediction, genomic analysis and gene recognition, and the design and interpretation of experiments involving macromolecular arrays.

STUDENT LEARNING OBJECTIVES:

- 1: Retrieve, manipulate, and analyze biological sequence/structure data, including pairwise and multiple sequence alignments, three-dimensional structure comparisons, and phylogenetic-tree construction.
- 2: Understand the underlying physics and mathematics of protein-fold predictions and the strengths and weaknesses of knowledge-based and ab initio folding calculations.
- 3: Retrieve, analyze, and interpret high-throughput biological data such as genomic sequences at the chromosomal, contig, and nucleotide-sequence level or data from nucleic-acid or protein microarrays.

REQUIRED TEXTBOOK: *Bioinformatics and Functional Genomics*, 3rded
By Jonathan Pevsner
Wiley-Blackwell, Hoboken, NJ; 2015
ISBN 9781118581780

ADDITIONAL READINGS: Other assigned or recommended readings, including journal articles, as appropriate.

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OTHER REQUIREMENTS: All students registered for this class are required to have computer and internet access. Computer accounts can be obtained through UTD's Information Resources department at no cost. A hand-held calculator will be needed for all quizzes, homework, and exams. PDA-based calculator applications or sharing of calculators during quizzes and exams are not permitted.

Class schedule Fall 2016 (Dr. Levene will cover material from 8/23 until 10/11; Dr. Xuan from 10/13 until 12/6)

Week	Date	Topic	Date	Topic	Course Material
1	8/23	Biological databases	8/25	Biological databases (cont'd)	Ch. 2; Lecture 1
2	8/30	Sequence similarity, substitution matrices	9/1	Substitution matrices (cont'd)	Ch. 3; Lecture 2
3	9/6	Intro to pairwise alignment	9/8	Quiz; Dynamic programming	Ch. 3; Lecture 2
"	9/7	Last day to drop without a "W"			
4	9/13	Dynamic programming (cont'd); FASTA and BLAST	9/15	Basic BLAST	Chs. 3,4; Lectures 3,4
5	9/20	Advanced BLAST methods	9/22	Quiz, Advanced BLAST methods (cont'd)	Ch. 5; Lecture 4
6	9/27	Macromolecular modeling	9/29	Protein-structure analysis and prediction	Ch. 13; Lectures 5,6
7	10/4	Protein-structure analysis and prediction	10/6	Exam 1 review	"
8	10/11	Exam No. 1 (covers all material up to 10/6)	10/13	Multiple sequence alignment	Chs. 6, 7
9	10/18	Multiple sequence alignment (cont'd)	10/20	Phylogenetic tree construction	"
10	10/25	Phylogenetic tree construction (cont'd)	10/27	Quiz, Genomes and genome sequencing	Chs. 13, 19
11	11/1	Genome browsers	11/3	Application of genome browsers	Ch. 19
12	11/7	Last day to withdraw with an automatic "W"			
"	11/8	Comparative genomics	11/10	Comparative genomics (Cont'd), take-home project distributed	Chs. 15, 16
"	11/15	Gene prediction	11/17	Gene prediction (Cont'd)	Ch. 16
14	11/22	Fall break (no class)	11/24	Thanksgiving Day (no class)	N/A
15	11/29	Gene prediction (cont'd)	12/1	Intro to next-generation sequencing, take-home project due.	Ch. 16
16	12/6	Exam 2 review			
17	TBD	Exam No. 2 (covers all material 10/13-12/1)			

GRADING: In-class quizzes (30%); take-home project (25%); two 75-min exams (45%). Occasional ungraded homework assignments (and answers) will be posted as a study aid.

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Course Policies

Make-up exams: No makeup quizzes will be given. There will be no make-up exams except for the most extreme of documented emergencies.

Use of portable electronics: Laptop computers, cellular telephones, and pagers must be turned off and put away during lectures and exams.

Student Conduct & Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records (consult <http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-AvoidDishonesty.html> for further information). Students suspected of academic dishonesty are subject to disciplinary proceedings.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

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Email Use

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

Student Grievance Procedures

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's *Handbook of Operating Procedures*.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the dean will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.

Incomplete Grade Policy

Per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of F.

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Disability Services

The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. Office hours are Monday and Thursday, 8:30 a.m. to 6:30 p.m.; Tuesday and Wednesday, 8:30 a.m. to 7:30 p.m.; and Friday, 8:30 a.m. to 5:30 p.m.

The contact information for the Office of Disability Services is:

The University of Texas at Dallas, SU 22

PO Box 830688

Richardson, Texas 75083-0688

(972) 883-2098 (voice or TTY)

Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance.

It is the student's responsibility to notify his or her professors of the need for such an accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.

Religious Holy Days

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.

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Off-Campus Instruction and Course Activities

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at the website address given below. Additional information is available from the office of the school dean. (http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm).

Concealed Handgun Policy

The UT-Dallas policy regarding concealed handguns is in compliance with the requirements of Senate Bill 11 of the Texas legislature. Details of this policy can be found at <http://www.utdallas.edu/campuscarry/policy.pdf>. Please note that under this policy both the Bioengineering and Sciences Building (BSB) and the Natural Sciences and Engineering Research Laboratory (NSERL) are designated as campus handgun exclusion zones.