

MDSC 401

Introduction to Bioinformatics

Instructors:

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HMRB 268

Office Hours/Policy on Answering Student Emails

Office Hours: Wednesdays, 3-4:30pm
Student emails will be answered within 3 weekdays

Time and Location:

2019/01/10 - 2019/04/12
Wednesdays: 12:00-2:45pm
HS 1501

Prerequisite/Co-Requisite:

6 units (1.0 full-course equivalent) in Computer Science at the 300 level or Medical Science 341 and 351 or 6 units (1.0 full-course equivalent) in Biological Sciences at the 300 level or consent of the instructor.

Course Description:

This introductory course will familiarize students with algorithms and computational techniques for bioinformatics applications. Topics to be covered include algorithm and search engines for the analysis of nucleic acid and protein sequences and structures; machine learning techniques for biological data analysis; systems biology approaches for computational modelling.

Overarching Theme

Bioinformatics is a field defined by process; that is, it involves the practical application of computational analyses, tools, and algorithms, in order to answer questions about biology. This course will cover some of the major streams in contemporary bioinformatics. It will be organized in such a way as to survey these broad subjects while ensuring students are integrated in the practical considerations that go into bioinformatics projects, as well as the interpretation of bioinformatics data. Class is scheduled in one three-hour block once per week, and will include portions that are lecture-based, discussion-based, and/or assignment-based. Attendance is critical to effectively completing the course.

Global Objectives

- To prepare students to participate in active research programs involving Bioinformatics techniques and analyses.

Learning Objectives

By the end of this course, students will be able to:

- Access and analyze published datasets from databases such as Genbank.
- Articulate the statistical basis and computational considerations behind key bioinformatic analyses, such as sequence alignments and structural models.
- Design and execute a bioinformatic project using publicly available datasets.
- Work effectively within groups to visualize analysis results, and to effectively communicate the meaning from that work in both group discussions and in written papers.
- Effectively design a computational approach to solve questions in biology.

Required Textbooks

Elementary Sequence Analysis, by Brian Golding, Dick Morton, and Wilfred Haerty. 2018. Available by download as .pdf at: http://helix.mcmaster.ca/3S03_2018.pdf or on D2L.

Recommended Textbooks/Readings

A list of required readings will be outlined on D2L and links and documents will be made available, where possible. Required readings have been chosen carefully to inform you and enhance the lecture material. **Students are REQUIRED to complete assigned readings BEFORE each lecture.** Instructors will proceed in class on the assumption that students have read completely the assigned readings. Students should be aware that many of the readings they will be assigned may be of an unfamiliar nature and style. Students should allot sufficient time to allow for several reads of the assigned material.

Evaluation

The University policy on grading and related matters is described in section F.2 of the 2018-2019 Calendar.

In determining the overall grade in the course, the following weights will be used:

Engagement	10%
In-class assignments	20%
Project Proposal	10%
Project Discussion	10%
Final Paper	30%
Final Exam	20%

A Note regarding Writing Assignments:

Writing skills are important to academic study in all disciplines. In keeping with the University of Calgary's emphasis on the importance of academic writing in student assignments (section E.2 of 2018-19 Calendar), writing is emphasized, and the grading thereof in determining a student's mark in this course. The Bachelor of Health Sciences values excellence in writing. Competence in writing entails skills in crafting logical, clear, coherent, non-redundant sentences, paragraphs and broader arguments, as well as skills with the mechanics of writing (grammar, spelling, punctuation). The University of Calgary offers a number of instructional services through the Students' Success Centre's Writing Support Services (<http://www.ucalgary.ca/writingsupport/>) for students seeking feedback on assignments or seeking to improve their general writing skills. Students are **strongly encouraged** to take advantage of these programs.

Grading Scheme:

A+ 97-100%	B+ 80-84%	C+ 65-69%	D+ 54-56%
A 90-96%	B 75-79%	C 60-64%	D 50-53%
A- 85-89%	B- 70-74%	C- 57-59%	F 0-49%

Missed Components of Term Work:

Students will lose 5% per day late past the deadline for all assignments. Assignments will **NOT** be accepted more than 72 hours after the posted deadline and students failing to submit any assignment within this time frame will receive a mark of zero. **Students who miss an in-class assignment will receive a mark of zero unless the instructor has been previously notified.** **There will be NO exceptions to this policy.**

The only exceptions to this are those in keeping with the University Calendar (debilitating illness, religious conviction, or severe domestic affliction) that are received in writing and with supporting documentation. Traffic jams and late or full buses are common events in Calgary and are NOT acceptable reasons for late arrivals to class, meetings and examinations. Please note that while absences are permitted for religious reasons, students are responsible for providing advance notice and adhering to other guidelines on this matter, as outlined in the University Calendar (<https://www.ucalgary.ca/pubs/calendar/current/e-4.html>).

Brightspace by Desire2Learn (D2L)

Brightspace (by D2L) is located on the University of Calgary server and will be used extensively for communication with students. **It is the student's responsibility to ensure that they receive all posted communications and documents and that they receive emails sent by instructors or fellow students through D2L.** Only your @ucalgary.ca email address may be linked to D2L. Please ensure that you are regularly checking your @ucalgary.ca account.

If you need help accessing or using D2L, please visit the Desire2Learn resource page for students: <http://elearn.ucalgary.ca/d2l-student/>.

Policies Governing the Course:

Attendance

Attendance will not be measured directly; however, most classes will include an in-class assignment. These assignments are worth a substantial portion of your final grade (20%), and so attendance is critical to achieving a high mark overall. An additional 10% comes from overall “engagement”, which will also be impacted by consistent absences.

Conduct During Lectures

The classroom should be respected as a safe place to share ideas without judgement - a community in which we can all learn from one another. Students are expected to conduct themselves in a mature and courteous manner during ALL lectures. Students are expected to frame their comments and questions to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic.

Students are expected to take notes during class and should not rely solely on material supplied by the instructors.

Electronic Devices

The Bachelor of Health Sciences program aims to create a supportive and respectful learning environment for all students. Research studies have found that student use of electronic devices (laptops, tablets, etc) in the classroom negatively affects the learning of both the user and those sitting nearby. Inappropriate use of laptops is also disruptive to your fellow classmates and disrespectful to the lecturer. The use of laptops and other electronic note-taking devices is permitted; however, their use in the classroom should be for course-related work/note-taking only. Please do **NOT to surf the web, check email or do other unrelated work**. Students who use their laptops inappropriately or are otherwise disruptive during lectures will be asked to leave.

Cell phones (or similar devices) should **be turned off** (not merely silent) upon entering the classroom. Sending/receiving text messages or leaving the class to take calls is disruptive to the entire class and will not be tolerated unless absolutely necessary. Students who disregard this rule during lectures or tutorials will be asked to leave. These items are not permitted under any circumstance during exams/quizzes, etc.

Copyright

It is the responsibility of students and professors to ensure that materials they post or distribute to others comply with the Copyright Act and the University’s Fair Dealing Guidance for Students (library.ucalgary.ca/files/library/guidance_for_students.pdf). Further information for students is available on the Copyright Office web page (<http://library.ucalgary.ca/copyright>)

A Note Regarding Instructor Intellectual Property

Generally speaking, course materials created by professor(s) (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the professor(s). These materials may **NOT** be reproduced, redistributed or copied without the explicit consent of the professor. **The posting of course materials to third party websites such as note-sharing sites without permission is prohibited.** Sharing of extracts of

these course materials with other students enrolled in the course *at the same time* may be allowed under fair dealing.

Academic Accommodations Based on Disability or Medical Condition

It is the student's responsibility to register with Student Accessibility Services to be eligible for formal academic accommodation in accordance with the Procedure for Accommodations for Students with Disabilities (https://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf). If you are a student who may require academic accommodation and have not registered with Student Accessibility Services, please contact their office at (403) 220-8237; <http://www.ucalgary.ca/access/>. Students will be provided with all necessary accommodations to ensure equal opportunity to succeed in this course. Please provide the instructor your accommodation letter from Student Accessibility Services within 14 days after the start of this course so that all needed arrangements for exams and assignments can be made.

Accommodations on Protected Grounds other than Disability

Students who require an accommodation in relation to their coursework based on a protected ground other than disability, should communicate this need, preferably in writing, to the designated BHSc program contact, Mrs. Jennifer Logan (jllogan@ucalgary), or to Dr. Ebba Kurz, Associate Dean, Undergraduate Health and Science Education, Cumming School of Medicine. Students who require an accommodation unrelated to their coursework or the requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Vice-Provost (Student Experience). For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/.

Academic Misconduct

The University of Calgary is committed to the highest standards of academic integrity and honesty. The University of Calgary has created rules to govern all its members regarding the creation of knowledge and the demonstration of knowledge having been learned. These rules are contained principally in Sections J to L of the *University of Calgary Calendar*. Students are expected to be familiar with these standards and to uphold the policies of the University in this respect. The Calendar also stipulates the penalties for violating these rules. Please know that the University and the Cumming School of Medicine take these rules seriously. **All incidences of academic dishonesty in this course, such as cheating and plagiarism, will be reported to the Associate Dean for investigation;** infractions will be noted on the record of a student found to be guilty.

Recording of Lectures

Audio or video recording of lectures is prohibited except where explicit permission has been received from the instructor.

Other Important Information

Freedom of Information and Protection of Privacy Act

This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP); students should identify themselves on written assignments (exams and term work) by their name and ID number on the front page and ID on each subsequent page. Work

assigned to you by your course instructor will remain confidential unless otherwise stated before submission. The assignment cannot be returned to anyone else without your expressed permission to the instructor. Grades will be made available on an individual basis and students will not have access to other students' grades without expressed consent. Similarly, any information about yourself that you share with your course instructor will not be given to anyone else without your permission. See <http://www.ucalgary.ca/policies/files/policies/privacy-policy-2011.pdf> for more information.

Appeals

If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section I of the University Calendar. Students must follow the official reappraisal/appeal process and may contact the Student Ombuds' Office (<http://www.ucalgary.ca/ombuds>) for assistance with this and with any other academic concerns, including academic and non-academic misconduct. Students should be aware that concerns about graded term work may only be initiated **within 15 days** of first being notified of the grade.

Resources for Support of Student Learning, Success, Safety and Wellness

Student Success Centre	http://www.ucalgary.ca/ssc/
Student Wellness Centre	http://www.ucalgary.ca/wellnesscentre/
Distress Centre	http://www.distresscentre.com/
Library Resources	http://library.ucalgary.ca

Wellness and Mental Health Resources

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370 MacEwan Student Centre, <https://www.ucalgary.ca/wellnesscentre/services/mental-health-services>) and the Campus Mental Health Strategy (<http://www.ucalgary.ca/mentalhealth/>).

Student Ombuds' Office

The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit www.ucalgary.ca/ombuds/ or email ombuds@ucalgary.ca

Student Union (SU) Information

The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; the SU representatives for the Cumming School of Medicine can be reached at medrep1@su.ucalgary.ca or medrep2@su.ucalgary.ca.

Emergency Evacuation/Assembly Points

Assembly points for emergencies have been identified across campus. Assembly points are designed to establish a location for information updates from the emergency responders to the evacuees; and from the evacuated population to the emergency responders. The primary assembly point for the Health Sciences Centre is the HRIC Atrium. The alternate assembly point

is HMRB Atrium. For more information, see the University of Calgary's Emergency Management website: <http://www.ucalgary.ca/emergencyplan/assemblypoints>.

Safewalk

Campus security will escort individuals, day or night, anywhere on campus (including McMahon Stadium, Health Sciences Centre, Student Family Housing, the Alberta Children's Hospital and the University LRT station). Call 403-220-5333 or visit <http://www.ucalgary.ca/security/safewalk>. Use any campus phone, emergency phone or the yellow phone located at most parking lot pay booths. Please ensure your personal safety by taking advantage of this service.

Class Schedule

The following is a list of topics for class, associated readings, and assignment / exam due dates. Please note that unforeseen circumstances may cause changes to the schedule with respect to the timing of topics and readings. Students will be notified of all changes in a timely manner by way of email and D2L announcements. The exam dates are firm and will not be altered.

Date	Module / Topics	Instructor/Guest Lecturer	Readings	Assignments & Due Dates
Jan 16	Database forms and functions	Dave Anderson	Elementary Sequence Analysis (ESA), Ch. 1 and 4	In class
Jan 23	Generating data and extracting information	Dave Anderson	ESA, Ch. 3 and 5	In class
Jan 30	Probability and "Alignment"	Dave Anderson	BLAST reading; Structural alignment reading (on D2L)	In class
Feb 6	Interpreting alignment "scores"	Dave Anderson	ESA ch. 6	Take home (due by the start of class on Feb. 13)
Feb 13	Trade-offs in modern alignment algorithms	Dave Anderson	Survey of sequence alignment tools (on D2L)	In class
Feb 20	Reading Week Break			
Feb 27	Transition matrices and "searching" databases	Dave Anderson	ESA ch. 7 and 8	In class Project groups assigned
Mar 6	Phylogenetic and ancestral sequence reconstruction	Dave Anderson	ESA ch. 9 Functional synthesis reading (on D2L)	Project proposals due by the start of class on March 13
Mar 13	Describing sequence "patterns"	Dave Anderson	ESA ch. 10	In class
Mar 20	Markov models and genome annotation	Dave Anderson	ESA ch. 11	In class
Mar 27	Project "discussion" presentations	Everybody!		Group presentations in class
Apr 3	Other "Omics" approaches	Dave Anderson	RNA-seq reading (on D2L)	In class

				Final projects due at start of class on Apr 10
Apr 10	Molecular Modelling	Dave Anderson	Molecular Modelling reading (on D2L)	In class

Final Exam to be scheduled by the Registrar