The University of Calgary
Bachelor of Health Sciences
Cumming School of Medicine

Academic Year 2021-2022

MDSC 301
Introduction to Bioinformatics

Instructor:

Tatiana Maroilley, PhD
tatiana.maroilley@ucalgary.ca

Office Hours/Policy on Answering Student Emails

Please note that all course communications must occur through your @ucalgary email, and I will respond to emails sent via student's @ucalgary emails within 48 hours.

Teaching Assistants:

Mohammad Imam Hasan Bin Asad
mohammadimamhasanbin@ucalgary.ca

Time and Location:
2022/01/10 - 2022/04/11
O1501
Monday, Wednesday: 10:30am-11:45am

Prerequisite/Co-Requisite:
6 units (1.0 full-course equivalent) in Computer Science at the 300 level; or Medical Science 341; 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.

In person/Online course:
Based on pandemic-related restriction and UCalgary mandated guidelines, classes scheduled until Jan 28th 2022 will be delivered online via a zoom site provided by the lecturer. Subsequently the course will move to in-person classes with the caveat that this may change and have to revert to online delivery should provincial or University guidelines mandate this. Should this be the situation, students will be given as much advance notice as possible about the arrangements for course delivery and evaluation.

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 two

1.15 hour blocks per week and will include portions that are lecture-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.

Course Learning Outcomes

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

• Access and analyze published datasets from databases.

• Articulate the statistical basis and computational considerations behind key bioinformatic analyses.

• 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.

Recommended Textbooks/Readings

- Trent R. (eds) Clinical Bioinformatics. Methods in Molecular Biology (Methods and Protocols), vol 1168. Humana Press, New York, NY. https://link-springer-com.ezproxy.lib.ucalgary.ca/book/10.1007/978-1-4939-0847-9 (log in using your UCalgary account to get access)
- 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
- Jeremy Ramsden. Bioinformatics. An Introduction. 2015. ed. 3 https://link.springer.com/book/10.1007/978-1-4471-6702-0 (log in using your UCalgary account to get access)

Learning Technology Requirements

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.

Evaluation

The University policy on grading and related matters is described in section F of the 2021-2022 Calendar.

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

• Assignments	30%	
• Project Proposal	20%	March 14
• Project Presentation	20%	Weeks of April 4 and 11
• Final Paper	30%	due April 11 (start of class)

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 2021-22 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). Sources used in research papers must be properly documented. The University of Calgary offers 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:

Letter Grade	Description	Percentage
A+	Outstanding performance	96-100
A	Excellent performance	90-95
A-	Approaching excellent performance	85-89
B+	Exceeding good performance	80-84
B	Good performance	75-79
B-	Approaching good performance	70-74
C+	Exceeding satisfactory performance	65-69
C	Satisfactory performance	60-64
C-	Approaching satisfactory performance	57-59
D+	Marginal pass	54-56
D	Minimal pass	50-53
F	Did not meet course requirements	0-49

Missed Components of Term Work:
Students will lose 5% per day late past the deadline for all assignments. 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. 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).

Course Evaluations and Student Feedback
Student feedback will be sought at the end of the course through the Universal Student Rating of Instruction (USRI) and a qualitative student evaluation. Students are welcome to discuss the process and content of the course at any time with the instructor. Students may also address any concerns they may have with Dr. Ebba Kurz, Associate Dean (Undergraduate Health and Science Education) in the Cumming School of Medicine (kurz@ucalgary.ca).

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 frame their comments and questions

to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic. Students, employees, and academic staff are also expected to demonstrate behaviour in class that promotes and maintains a positive and productive learning environment.

As members of the University community, students, employees and academic staff are expected to demonstrate conduct that is consistent with the University of Calgary Calendar, the Code of Conduct and Non-Academic Misconduct policy and procedures, which can be found at https://www.ucalgary.ca/legal-services/university-policies-procedures.

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

Use of Internet and Electronic Communication Devices in Class
The Bachelor of Health Sciences program aims to create a supportive and respectful learning environment for all students. The use of laptop and mobile devices is acceptable when used in a manner appropriate to the course and classroom activities. However, research studies have found that inappropriate/off-topic use of electronic devices in the classroom negatively affects the learning of others during class time.

Students are responsible for being aware of the University's Internet and email use policy, which can be found at https://www.ucalgary.ca/policies/files/policies/electronic-communications-policy.pdf .

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

Copyright
All students are required to reach the University of Calgary policy on Acceptable Use of Material Protected by Copyright (https://www.ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright-policy.pdf) and requirements of the Copyright Act (https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html) to ensure they are aware of the consequences of unauthorized sharing of course materials (including instructor notes, electronic versions of textbooks, etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy https://www.ucalgary.ca/pubs/calendar/current/k.html.

Instructor Intellectual Property
Course materials created by instructors (including course outlines, presentations and posted notes, labs, case studies, assignments, and exams) remain the intellectual property of the instructor. 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
It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The Student Accommodations policy is available at https://ucalgary.ca/student-services/access/prospective-students/academic-accommodations. Students needing an accommodation based on disability or medical concerns should contact Student Accessibility Services (SAS) 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.pdf). SAS will process the request and issue letters of accommodations to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/ .

Students who require an accommodation in relation to their coursework based on a protected ground other than disability should communicate this need in writing to Dr. Ebba Kurz, Associate Dean (Undergraduate Health and Science Education) (kurz@ucalgary.ca).

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.

Academic Misconduct refers to student behaviour that compromises proper assessment of a student's academic activities and includes (but is not limited to): cheating, fabrication, falsification, plagiarism, unauthorized assistance, failure to comply with an instructor's expectations regarding conduct required of students completing academic assessments in their courses, and failure to comply with exam regulations applied by the Registrar. **It also includes using of third-party websites/services to access past/current course material, essay/assignment writing services, or real-time assistance in completing assessments, seeking answers to assessment questions and similar, whether paid, bartered or unpaid.**

For information of the Student Academic Misconduct Policy and Procedures, please visit;
https://ucalgary.ca/policies/files/policies/student-academic-misconduct-policy.pdf
https://ucalgary.ca/policies/files/policies/student-academic-misconduct-procedure.pdf

Additional information is available on the Academic Integrity website at: https://ucalgary.ca/student-services/student-success/learning/academic-integrity.

Recording of Lectures
Audio or video recording of lectures (or similar) is **prohibited** except where explicit permission has been received from the instructor or it is an approved accommodation.

Freedom of Information and Protection of Privacy Act
Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary

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 10 business days** of first being notified of the grade. https://www.ucalgary.ca/pubs/calendar/current/i-2.html

Sexual and Gender-Based Violence Policy
The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence.

The University of Calgary's sexual and gender-based violence policy guides us in how we respond to incidents of sexual and gender-based violence, including supports available to those who have experienced or witnessed sexual or gender-based violence, or those who are alleged to have committed sexual or gender-based violence. It provides clear response procedures and timelines, defines complex concepts, and addresses incidents that occur off-campus in certain circumstances. Please see the policy available at https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Sexual-and-Gender-Based-Violence-Policy.pdf.

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 (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

BHSc Student Faculty Liaison Committee (SFLC)

The BHSc SFLC, with elected representatives from all majors, serves to raise issues of interest to BHSc students to the program administration, including items pertaining to curriculum, scheduling and events. A list of current representatives can be found on the BHSc website.

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.

Student Success Centre

The Student Success Centre provides services and programs to ensure students can make the most of their time at the University of Calgary. Our advisors, learning support staff, and writing support staff assist students in enhancing their skills and achieving their academic goals. They provide tailored learning support and advising programs, as well as one-on-one services, free of charge to all undergraduate and graduate students. For more information visit: https://www.ucalgary.ca/student-services/student-success

Emergency Evacuation/Assembly Points

As part of the University of Calgary Emergency Evacuation plan, students, faculty, and staff should locate the closest Assembly Point in case of Fire Alarm. Safety signage is posted throughout the campus showing the locations and the possible route to these locations. All students, faculty, and staff are

expected to promptly make their way to the nearest Assembly Point if the Fire Alarm is activated. No one is to return into campus facilities until an all clear is given to the warden in charge of the Assembly Area. For more information, see https://www.ucalgary.ca/emergencyplan/building-evacuation/assembly-points

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.

Winter term break: Feb 20-27, 2022
First class: Jan 10; Last class: April 12

Week	Session Date	Module / Topics	Instructor/Guest Lecturer	Assignments & Due Dates
1	2022-01-10	Introduction to Bioinformatics	Tatiana Maroilley	
1	2022-01-12	Unix and Bash	Tatiana Maroilley	Assignment 1 – Due before session Jan 17
2	2022-01-17	Algorithm and code	Tatiana Maroilley	
2	2022-01-19	Perl/Python	Tatiana Maroilley	Assignment 2 – Due before session Jan 24
3	2022-01-24	Sequencing technologies	Tatiana Maroilley	
3	2022-01-26	Manipulating omics data	Tatiana Maroilley	Assignment 3 – Due before session Jan 31
4	2022-01-31	Data format and databases	Tatiana Maroilley	
4	2022-02-02	Databases - Presentations	Tatiana Maroilley	Assignment 4 - In class
5	2022-02-07	Designing analyses	Tatiana Maroilley	
5	2022-02-09	Introduction to HPC	Tatiana Maroilley	Assignment 5 – Due before session Feb 14
6	2022-02-14	Biostatistics and data analyses	Tatiana Maroilley	
6	2022-02-16	Introduction to R	Tatiana Maroilley	Assignment 6 – Due before session Feb 28
7	2022-02-21	Reading week		
8	2022-02-28	Data visualization	Tatiana Maroilley	

8	2022-03-02	Projects	Tatiana Maroilley Dr. Shirin Moossavi	
9	2022-03-07	Analyzing omics data	Tatiana Maroilley	
9	2022-03-09	Projects	Tatiana Maroilley Imam Asad	
10	2022-03-14	Introduction to Galaxy	Dr. Claire Kamaliddin	Project proposals due by the start of class on March 14
10	2022-03-16	Projects	Tatiana Maroilley Dr. Claire Kamaliddin	
11	2022-03-21	Integrating omics data	Tatiana Maroilley	
11	2022-03-23	Projects	Tatiana Maroilley Dr. Michael Jonhston	
12	2022-03-28	Best practices and reproducibility	Tatiana Maroilley	
12	2022-03-30	Projects	Tatiana Maroilley Dr. Ted Verhey	
13	2022-04-04	Project “discussion” presentations	Everybody	In class
13	2022-04-06	Project “discussion” presentations	Everybody	In class
14	2022-04-11	Project “discussion” presentations	Everybody	In class Final projects due at start of class on Apr 11