



ANSC*6330 Topics in Computational Biology and Bioinformatics

Fall 2022

Section(s): C01

Department of Animal Biosciences

Credit Weight: 0.50

Version 1.00 - August 29, 2022

1 Course Details

1.1 Calendar Description

Major topics and methods in bioinformatics and computational biology for animal sciences will be covered. Topics include alignments, phylogenetics, genomics, data mining, databases, DNA, RNA and protein structures, DNA sequence analysis, data curation, pipeline construction and data visualization.

1.2 Course Description

The course will cover major topics and methods in bioinformatics and computational biology for animal sciences. Topics include alignments, phylogenetics, genomics, data mining, databases, DNA, RNA and protein structures, DNA sequence analysis, data curation, pipeline construction and data visualization. This is a project-based course and will have a computational component and a lab component focused on bioinformatics programming.

Note: The course is currently offered in person only.

1.3 Timetable

Timetable is subject to change. Please see WebAdvisor for the latest information.

Current timetable:

Lectures: Mondays and Wednesdays from 16:00 to 17:20, in-person (location: check WebAdvisor for updated info)

Lab schedule and location: Wednesdays from 9:30 to 11:30, in-person (location: check WebAdvisor for updated info)

First class: Monday, September 12, 2022

COVID-19 Disclaimer: please be aware that the information on course delivery, accessibility and examinations presented in this outline were developed based on current University guidelines. However, due to the continuously evolving situation and resulting changes in public health recommendations, the format and delivery of this course may be revised with limited notice.

1.4 Final Exam

There is no final exam. There is a final project report and presentation.

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Dan Tulpan
Email:	dtulpan@uoguelph.ca
Telephone:	+1-519-824-4120 x52482
Office Hours:	In-person, by email or online (Zoom, MSTeams, Skype, etc.).

2.2 Instructor's Role and Responsibility to Students

The instructor will facilitate discussions, present lecture notes in an interactive fashion, provide feedback to students, help with project direction and oversee/prepare the lab

activities.

3 Learning Resources

3.1 Recommended Resources

Support for lectures (Textbook)

J. Xiong, Essential Bioinformatics, Cambridge University Press, 2012, ISBN: 9780511806087, <https://doi.org/10.1017/CBO9780511806087>

Recommended Lab Book (Lab Manual)

C. Jamison, Perl Programming for Biologists, Wiley and Sons, 2003, ISBN: 978-0-471-43059-9.

3.2 Complementary resources

- Course notes will be used during the course (both available in the course's webpage).
- Extra pertinent information, such as papers, chapters of books, etc. will be accordingly recommended.
- Students are advised to take their own notes during lectures.

3.2 Course Technology and Technical Support

Course Technologies and Technical Support

System and Software Requirements

This course will use a variety of technologies including;

- *CourseLink (main classroom)*
- *Zoom*
- *Teams (via Office 365)*

To help ensure you have the best learning experience possible, please review the list of system and software requirements.

<https://opened.uoguelph.ca/student-resources/system-and-software-requirements>

CourseLink System Requirements

You are responsible for ensuring that your computer system meets the necessary system requirements. Use the browser check tool to ensure your browser settings are compatible and up to date. (Results will be displayed in a new browser window).

<http://spaces.uoguelph.ca/ed/system-requirements/>
<https://courselink.uoguelph.ca/d2l/systemCheck>

Course Technologies

CourseLink

This course is being offered using CourseLink (powered by D2L's Brightspace), the University of Guelph's online learning management system (LMS). By using this service, you agree to comply with the University of Guelph's Access and Privacy Guidelines. Please visit the D2L website to review the Brightspace privacy statement and Brightspace Learning Environment web accessibility standards.

<http://www.uoguelph.ca/web/privacy/> <https://www.d2l.com/legal/privacy/>
<https://www.d2l.com/accessibility/standards/>

Technical Support

If you need any assistance with the software tools or the CourseLink website, contact CourseLink Support.

Email: courselink@uoguelph.ca

Tel: 519-824-4120 ext. 56939 Toll-Free (CAN/USA): 1-866-275-1478

Support Hours (Eastern Time):

Monday thru Friday: 8:30 am–8:30 pm

Saturday: 10:00 am–4:00 pm

Sunday: 12:00 pm–6:00 pm

3.2 MS Teams and Zoom Technologies

Teams (via Office 365)

Office 365 Teams is a collaboration service that provides shared conversation spaces to help teams coordinate and communicate information. This course will use Teams for one on one meetings with your Instructor. It is recommended that you use the desktop version of Teams. As a student you are responsible for learning how to use Teams and it's features.

For Teams Support visit the CCS website for more information.

<https://www.uoguelph.ca/ccs/services/office365/teams>

Zoom

This course may use Zoom for office hours. Check your system requirements to ensure you will be able to participate.

<https://opened.uoguelph.ca/student-resources/system-and-software-requirements>

4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Understand bioinformatics data formats and types and be able to manipulate them using computer programming.
2. Perform and understand sequence alignments, gene predictions, phylogenetics and omics analyses.
3. Appreciate differences among bioinformatics methods and algorithms for both data curation and data analyses.
4. Be able to integrate different biological data sets via programming.
5. Discuss the relative merits of methods and designs used in bioinformatics and computational biology.
6. Be able to contribute to a team project and perform various types of data analyses.

7. Accurately and effectively communicate scientific analyses in written form.
 8. Have a proficient command terminology common in bioinformatics and computational biology.
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5 Teaching and Learning Activities

5.1 Lecture

Mon, Sep 13 - Wed, Dec 1

Topics:

Block 1

Topic: Biological data and databases

Block 2

Topic: Bioinformatics Programming

Block 3

Topic: Sequence alignments

Block 4

Topic: Gene and promoter prediction

Block 5

Topic: Molecular phylogenetics

Block 6

Topic: Structural bioinformatics

Block 7

Topic: Machine learning in bioinformatics

5.2 Labs

Wednesdays 9:30 -11:30 - in-person

Computer lab: Perl programming (please bring/use your own laptop/computer)

6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Assignment 1	6
Assignment 2	6
Assignment 3	6
Assignment 4	6
Assignment 5	6
Project presentation	30
Project report	40
Total	100

6.2 Assessment Details

Assignment 1 (6%)

Date: Week 3

Learning Outcome: 1, 2

Sequence Databases: 3 practical exercises

Programming: 1 exercise

Assignment 2 (6%)

Date: Week 5

Learning Outcome: 1, 2, 3

Sequence alignments: 5 practical exercises

Literature review and comparison: 1 exercise

Programming: 1 exercise

Assignment 3 (6%)

Date: Week 7

Learning Outcome: 1, 2, 3, 4

Multiple sequence alignment: 15 short practical exercises

Programming: 4 short exercises

Assignment 4 (6%)

Date: Week 9

Learning Outcome: 1, 2, 3, 4, 5

Phylogenetics: 9 short exercises

Programming: 2 short exercises

Assignment 5 (6%)

Date: Week 11

Learning Outcome: 1, 2, 3, 5, 7, 8

Structural bioinformatics: 2 short exercises

Machine learning in bioinformatics: 2 short exercises

Programming: 1 exercise

Project presentation (30%)

Date: December 7, 2022

Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8

Project report (40%)

Date: December 14, 2022

Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8

Due: December 14, 2022 at midnight

6.3 Notes

The project presentation will be up to 25 minutes long and will have a 5-10 minutes questions period. Presentation slides will be made available to the instructor and students two days in advance.

The project report will be structured as a journal article using the template of the **IEEE/ACM Transactions on Computational Biology and Bioinformatics journal** and will be submitted approx. one week after the presentation (**December 7, 2022 at or before midnight**). This will allow students to integrate feedback from presentations into reports. While groups of up to 4 students can work on the same project, the reports will be written individually. The topic of each project will be decided between students and shared with the instructor on the week of October 24, 2022. Alternatively, the instructor can also provide project topics to students who cannot decide.

Note: The exact dates for assignments, project presentation and project report are subject to change at the discretion of the instructor.

7 Course Statements

7.1 Grading Policies

All assignments, presentations and reports must be submitted by 11:59 pm of the due date. Late assignments will receive zero (0) marks.

7.2 Netiquette Expectations

Online Behaviour:

Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include:

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references
- Buying or selling term papers or assignments
- Posting or selling course materials to course notes websites
- Having someone else complete your quiz or completing a quiz for/with another student
- Stating false claims about lost quiz answers or other assignment submissions
- Threatening or harassing a student or instructor online
- Discriminating against fellow students, instructors and/or TAs
- Using the course website to promote profit-driven products or services
- Attempting to compromise the security or functionality of the learning management system
- Sharing your user name and password
- Recording lectures without the permission of the instructor

7.3 Dropbox Submissions

Assignments should be submitted electronically via the online **Dropbox** tool. When submitting your assignments using the **Dropbox** tool, do not leave the page until your assignment has successfully uploaded. To verify that your submission was complete, you can view the

submission history immediately after the upload to see which files uploaded successfully. The system will also email you a receipt. Save this email receipt as proof of submission.

Be sure to keep a back-up copy of all of your assignments in the event that they are lost in transition. In order to avoid any last-minute computer problems, your instructor strongly recommend you save your assignments to a cloud-based file storage (e.g., OneDrive), or send to your email account, so that should something happen to your computer, the assignment could still be submitted on time or re-submitted.

It is your responsibility to submit your assignments on time as specified on the Schedule. Be sure to check the technical requirements and make sure you have the proper computer, that you have a supported browser, and that you have reliable Internet access. Remember that **technical difficulty is not an excuse not to turn in your assignment on time**. Don't wait until the last minute as you may get behind in your work.

If, for some reason, you have a technical difficulty when submitting your assignment electronically, please contact your instructor or CourseLink Support.

<http://spaces.uoguelph.ca/ed/contact-us/>

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of

Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website

<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website

<https://www.ridgetownc.com/services/accessibilityservices.cfm>

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have

the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed

assessments or when involving a large part of a course (e.g.. final exam or major assignment).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
