

BIOCHEM 3BP3: PRACTICAL BIOINFORMATICS IN THE GENOMICS ERA

Contact Information

INSTRUCTOR

Andrew G. McArthur, Ph.D.
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Office hours by appointment only.

TEACHING ASSISTANTS

Jalees Nasir	nasirja@mcmaster.ca	T01
Madeline (Maddie) McCarthy	mccarm15@mcmaster.ca	T02
Karyn Mukiri	mukirikm@mcmaster.ca	T03

Office hours to be communicated by TAs.

COURSE WEBSITES, SCHEDULE, AND CLASSROOMS

Course information will be posted on **Avenue to Learn (A2L)**. Asynchronous communication will occur on **Microsoft Teams**. Lecture and tutorial content will be provided on **A2L** and at **github.com/agmcarthur/biochem-3bp3**. The course schedule will vary, including some weeks with or without lectures, tutorials, guest lectures, or facility tours (a detailed course schedule will be available on **GitHub**). Each student will perform one oral presentation (outlined below) and a schedule for these presentations will be available on **A2L**. Unless otherwise noted in the detailed schedule, the weekly schedule for lectures and tutorials will be:

Lecture	Tuesdays	12:30-1:20 pm	see Mosaic	all students
Tutorial Group 1	Fridays	2:30-4:20 pm	see Mosaic	T01 & Jalees
Tutorial Group 2	Thursdays	12:30-2:20 pm	see Mosaic	T02 & Maddie
Tutorial Group 3	Fridays	2:30-4:20 pm	see Mosaic	T03 & Karyn

Course Information

COURSE DESCRIPTION

Introduction to bioinformatics theory, tools, and practice with an emphasis on high-throughput DNA sequencing technologies. Areas of emphasis include gene sequence analysis, functional prediction, genome assembly and annotation, gene expression analysis, gene regulation analysis, genome databases, and microbial genomics. Includes an introduction to the command line, software development, and cloud computing.

COURSE OBJECTIVES

By the end of this course, the student should have practical skills with a number of bioinformatics techniques common in a modern research laboratory, familiarity with online databases and their use, and a knowledge of the use of genomics data for hypothesis testing.

PREREQUISITES

One of BIOCHEM 2B03 (or ISCI 2A18 A/B), BIOCHEM 3G03, BIOLOGY 2C03, MOLBIOL 2C03.

Materials and Fees

TEXTBOOK & CALCULATOR

This course does not use a textbook but will involve assigned readings from the primary scientific literature. This course does not require a calculator for assessments.

Course Requirements

GRADE BREAKDOWN AND DUE DATES

New topics will be introduced by **Lecture** on Tuesdays.

Lectures will be followed by **Tutorials** (i.e., labs) during the same week. Labs will generally include take-home work and assessments but will start with an in-person, 2-hour introductory session with a Teaching Assistant, during which three students will give **Flash Update** presentations + 3 live Kahoot questions & discussion. Take-home work will be supported by the Instructor and Teaching Assistants asynchronously via **Microsoft Teams**.

Labs will be posted on **GitHub**, with supplementary material available on **A2L**. Most labs will be graded, with students entering their answers via **A2L Quiz** (written answer & multiple choice).

In the middle of the course, students will perform a **Critical Review** (2 written pages) of a scientific paper that uses bioinformatics heavily.

The course will also include tours of the Faculty of Health Sciences DNA Sequencing Core and the SHARCNET national high-performance computing cluster, pending availability.

Throughout the term, Dr. McArthur will endeavour to host in-person or virtual office hours for 1-on-1 or small-group career development or mentorship Q&A sessions.

This course does not have tests, a mid-term, or a final exam.

Item Graded	% of Final Grade	Due Date
Lab Assignments (8)	40%	weekly
Flash Update Presentation	20%	varies
Lecture Quizzes (4)	20%	varies
Critical Review	20%	October 27, 2024

WORK SUBMISSION AND MARKING SCHEMES

Take-home lab assignments will involve short or multiple-choice questions based on an assigned bioinformatics analysis. These questions can be answered via **A2L Quiz** or by text and figures within a supplied WORD file that is to be submitted to the assessment drop box on **A2L**. All other assessments will be submitted via the assessment drop box on **A2L**. All assignments are to be submitted to **A2L** by 11:59 pm on the date the assignment is due unless otherwise stated. The Critical Review is to be submitted to the assessment drop box on **A2L** by 11:59 pm on October 27, 2024. Throughout the term, each student will give a single 10-minute Flash Update presentation on an assigned topic and must upload their slides to **A2L** before the start of their tutorial. No additional time will be provided for any assessments based on technical difficulties. Marking rubrics for all assessments are available on **A2L** or in the **GitLab** tutorial details.

LATE WORK OR MISSED WORK

Late penalties will be assessed at 10% per day, including weekends. After 4 days, the assignment will not be accepted and a grade of 0 will be assigned. If you are absent from the university for a medical reason, you may report your absence using the McMaster Student Absence Form (www.mcmaster.ca/msaf) using either the MSAF (Self Report) for absences not longer than 3 days & work worth not greater than 25% of the final grade or MSAF (Administrative) for absences longer than 3 days or work worth more than 25% of the final grade. After filling out the MSAF you must immediately contact the Instructor (normally within 2 working days) by email to learn what relief may be granted for the work you have missed and relevant details for submission.

REMARKING WORK

If you would like to have any work re-graded, please adhere to the Department of Biochemistry and Biomedical Sciences Regrading Policy available at the following website:
<https://biochem.healthsci.mcmaster.ca/education/undergraduate/forms-and-procedures/>

COURSE SCHEDULE

Week	Lecture Topics	Activities & Assignments
1	Introduction to Bioinformatics	tours of SHARCNET & SeqCore
2	Genome Databases	tours, lab, 3 student presentations
3	Sequence Similarity & Searching	lab, 3 student presentations
4	Evolutionary Biology	lab, 3 student presentations
5	Beyond Genes, Networks, Ontologies	lab, 3 student presentations
6	Linux & Sequencing Informatics	demo lab, 3 student presentations
7	<i>mid-term recess</i>	n/a
8	DNA Sequencing & Genome Assembly	lab, 3 student presentations
9	Molecular Epidemiology	lab, 3 student presentations
10	Gene Expression Analysis	demo lab, 3 student presentations
11	RNA-Seq, ChIP-Seq, etc.	lab, 3 student presentations
12	Guest Lecture	guest lab, 3 student presentations
13	Advances in DNA Sequencing	none
14	Genomics of Pandemics	none

University Policies

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g., the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy (<http://www.mcmaster.ca/academicintegrity>).

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g., the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

USE OF GENERATIVE ARTIFICIAL INTELLIGENCE (AI)

While we acknowledge that the use of Generative AI, such as ChatGPT, may be helpful to your learning, we require you to act with academic integrity when being assessed. Currently, assessments have not been designed with Generative AI tools in mind and using them threatens the integrity of the assessment. The main purpose of a university is the pursuit of knowledge and scholarship. As a student at McMaster University, you are expected to practice intellectual honesty and to fully acknowledge the work of others by providing appropriate references in your scholarly work. You must not take credit for work that is not your own. Please note that the McMaster University Academic Integrity policy states under item 18(c) that "It shall be an offence knowingly to ... submit academic work for assessment that was purchased or acquired from another source."

AUTHENTICITY AND PLAGIARISM DETECTION

This course may use a web-based service (turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to turnitin.com or via an online learning platform (e.g., A2L, etc.) using plagiarism detection (a service supported by turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster’s use of turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSE ONLINE CONTENT

In this course we will be using Avenue to Learn as our online resource. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster email accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have questions or concerns about such disclosure, please discuss this with the course instructor.

ONLINE PROCTORING

This course does not use online proctoring software for tests and exams.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online. It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviors that interfere with university functions on online platforms (e.g., use of Avenue 2 Learn, WebEx or ZOOM for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors. The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the Instructor if this is a concern for you.

ASSIGNMENT DEADLINES AND MISSED OR LATE WORK

All written work must be submitted on the due date, as outlined above. It is the student’s responsibility to ensure you have uploaded your assignment to the correct folder. Assignments submitted to incorrect folders risk incurring late penalties. Late penalties will not be waived unless your Faculty/Program Office advises the instructor that you have submitted to that office the appropriate documentation to support your inability to submit the work by the due date.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

In the event of an absence for medical or other reasons, students should review and follow the Policy on Requests for Relief for Missed Academic Term Work.

STUDENT ACCESSIBILITY

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

All visual lecture and lab material (e.g., Powerpoint, PDF) will be provided in advance on A2L and/or GitHub. In addition, all lectures will be recorded and provided as videos in a timely manner to the entire class. There are no in-class evaluations in this course, all assignments are take-home and not due for at least 7 days, including lecture quizzes. The exception is the student's 10 minute Flash Update presentation, but this can alternatively be provided as a recorded video (please inform instructor and TA if this will not be ready at the time of the tutorial so we can accommodate). There are no tests or exams in this course.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their Instructor as soon as possible to make alternative arrangements for classes, assignments, and tests.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labor disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

CHANGE TO THE COURSE OUTLINE

The Instructor and University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and opportunity to comment on changes. It is the responsibility of students to check their McMaster email accounts and course websites weekly during the term and to note any changes.