BIOCHEMISTRY 3BP3: PRACTICAL BIOINFORMATICS IN THE GENOMICS ERA

INSTRUCTOR

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TEACHING ASSISTANTS

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COURSE WEBSITE

Course information will be posted on Avenue to Learn; if this course is not visible on your Avenue page, please contact Dr. McArthur. Lecture and tutorial content will be provided at https://github.com/agmcarthur/Biochem-3BP3. Asynchronous communication will be provided at http://biochem3bp3.slack.com; contact Dr. McArthur if you do not get an invitation by the start of classes.

COURSE DESCRIPTION

Introduction to bioinformatics theory, tools, and practice with an emphasis upon 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, microbial genomics. Includes introduction to the command line, software development, and cloud computing.

FALL 2020

Lectures: Tuesday 12:30-1:20 pm
Tutorial 1 (30 students): Wednesday 2:30-6:30 pm
Tutorial 2 (30 students): Friday 2:30-6:30 pm
All lab, lectures, & tutorials online.

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

GRADE BREAKDOWN AND DUE DATES
New topics will be introduced by lecture on Tuesdays. Lectures will be synchronous via ZOOM but also recorded for asynchronous viewing.

Lectures will be followed by labs and additional lectures during the following Wednesday & Friday sessions. Labs will generally be take home, but will start with a ZOOM synchronous introductory session with a teaching assistant, during which three students will give Flash Update presentations + 3 live Kahoot questions & discussion. Teaching assistants will take attendance as 10% of total grade is participation in the Flash Update Q&A. The course Instructor will attend all synchronous lab sessions.

Labs will be posted on GitHub and all the data/software provided via Docker or an equivalent software platform (unless entirely web based); training will be provided. Most labs will be graded, with students entering their answers in A2L.

In the middle of the term, students will perform a critical review of a scientific paper that uses bioinformatics heavily. All students will answer the same suite of long & short answers on A2L.

Near the end of the course, students will complete an additional essay assignment.

Throughout the term, Dr. McArthur will host 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.

<table>
<thead>
<tr>
<th>Item Graded</th>
<th>% of Final Grade</th>
<th>Due Date</th>
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<tbody>
<tr>
<td>Lab Assignments (9)</td>
<td>45%</td>
<td>weekly</td>
</tr>
<tr>
<td>10 minute Presentation</td>
<td>15%</td>
<td>varies</td>
</tr>
<tr>
<td>Lab Participation</td>
<td>10%</td>
<td>weekly</td>
</tr>
<tr>
<td>Critical Review</td>
<td>15%</td>
<td>October 27, 2020</td>
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<tr>
<td>Essay Assignment</td>
<td>15%</td>
<td>December 8, 2020</td>
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WORK SUBMISSION
All assignments are to be submitted to the drop box on Avenue to Learn by 11:59 pm on the date the assignment is due, unless otherwise stated. Please submit your assignment as a WORD file unless otherwise specified. No additional time will be provided for technical difficulties.
**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 minor medical reason, lasting fewer than 3 days, you may report your absence, one per term, without documentation, using the McMaster Student Absence Form (www.mcmaster.ca/msaf/). Absences for a long duration or for other reasons must be reported to the Associate Dean of Science office, with documentation, and relief may not necessarily be granted. After filling out the MSAF you must immediately contact your course 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 or location of make-up test. Please note that the MSAF may not be used for term work worth 25% or more, nor can it be used for the final exam.

**Remarking Work**

If you would like to have any work regraded, please adhere to the Department of Biochemistry and Biomedical Sciences Regrading Policy available at the following website under regarding requests:

http://fhs.mcmaster.ca/biochem/undergraduate/forms_and_procedures.html

**Course Schedule**

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<thead>
<tr>
<th>Week</th>
<th>Lecture Topics</th>
<th>Activities &amp; Assignments</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to Bioinformatics</td>
<td>virtual tour sequencing core</td>
</tr>
<tr>
<td>2</td>
<td>Docker &amp; Genome Databases</td>
<td>tour SHARCNET, lab, 3 student presentations</td>
</tr>
<tr>
<td>3</td>
<td>Sequence Similarity Searching</td>
<td>lab, 3 student presentations</td>
</tr>
<tr>
<td>4</td>
<td>Evolutionary Biology</td>
<td>lab, 3 student presentations</td>
</tr>
<tr>
<td>5</td>
<td>Beyond Genes, Networks, Ontologies</td>
<td>lab, 3 student presentations</td>
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<tr>
<td>6</td>
<td><strong>- Mid-Term Recess -</strong></td>
<td>n/a</td>
</tr>
<tr>
<td>7</td>
<td>Linux &amp; DNA Sequencing</td>
<td>demo, 3 student presentations</td>
</tr>
<tr>
<td>8</td>
<td>Genome Assembly</td>
<td>lab, 3 student presentations</td>
</tr>
<tr>
<td>9</td>
<td>Molecular Epidemiology</td>
<td>lab, 3 student presentations</td>
</tr>
<tr>
<td>10</td>
<td>Gene Expression Analysis</td>
<td>demo, 3 student presentations</td>
</tr>
<tr>
<td>11</td>
<td>RNA-Seq, ChIP-Seq, etc.</td>
<td>lab, 3 student presentations</td>
</tr>
<tr>
<td>12</td>
<td>Advances in DNA Sequencing</td>
<td>Human Genetics Week, 3 student presentations</td>
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<tr>
<td>13</td>
<td>Genomics of SARS-CoV-2</td>
<td>Pandemic Week; COVID19 Guest Speakers</td>
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<tr>
<td>14</td>
<td>Internet of Things &amp; Big Data</td>
<td>n/a</td>
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**Assignment & Presentation Marking Schemes**

Take home lab assignments will involve short or multiple-choice questions based on an assigned bioinformatics analyses. These questions can be answered via A2L or by text and figures within a supplied WORD file that is to be submitted to the drop box on Avenue to Learn. The Critical Review and Essay Assignments are to be submitted to the drop box on Avenue to Learn by 11:59 pm on October 27, 2020 and December 8, 2020, respectively. Throughout the term, each student will give a single 10 minute presentation on an assigned topic. Marking rubrics are available on Avenue to Learn.
ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behavior in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

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 behavior 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. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

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.

AUTHENTICITY AND PLAGIARISM DETECTION

*Some courses 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.

AVENUE TO LEARN

In this course we will use Avenue to Learn (A2L). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, usernames for the McMaster e-mail 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 a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course Instructor.
**ONLINE PROCTORING**

*Some courses may* use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

**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 (exclusively through submission folders on Avenue to Learn). It is YOUR 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**

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”. It is the prerogative of the Instructor to determine the appropriate relief for missed work. *It is your responsibility to follow up with your Instructor immediately about the nature of the accommodation.*

**ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University’s *Academic Accommodation of Students with Disabilities* policy.
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 instructors 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.