

**Faculty of Science Course Syllabus  
Department of Biochemistry and Molecular Biology  
BIOINFORMATICS – BIOC 4010/5010  
Winter 2019**

- Instructor(s):** **Andrew Roger (coordinator)**, Rm. 8-D2, Sir Charles Tupper Medical Building, Tel: 494-2620, email: [andrew.roger@dal.ca](mailto:andrew.roger@dal.ca)  
<http://bloodroot.biochem.dal.ca/rogerlab.ca/teaching.php>  
Office hours: 2:30-3:30 Tuesday/Thursday right after class
- Christian Blouin**, Rm. 206, Goldberg Computer Science Building, Tel: 494-6702, email: [cblouin@dal.ca](mailto:cblouin@dal.ca)
- Dan Gaston**, Rm. 511, Mackenzie Building, Tel: 473-7219  
email: [daniel.gaston@dal.ca](mailto:daniel.gaston@dal.ca)
- Teaching assistant** **Shannon Sibbald**, Rm. 8H1, Sir Charles Tupper Medical Building  
email: [Shannon.Sibbald@Dal.Ca](mailto:Shannon.Sibbald@Dal.Ca)
- Time:** Tuesday and Thursday, 1:00 – 2:30 pm
- Place:** Lectures: McCain 2162  
Labs: Computer Teaching Lab, Goldberg Computer Science Building
- Lectures and Labs:** The attached schedule of lectures indicates the approximate order in which topics will be discussed in the course.
- Workshops:** Occasional workshops or student presentations may be organized during the term at mutually agreed upon locations and times.
- Tutorials:** n.a.

**Course Description:** This course presents the theory and practice of bioinformatics. Topics include: rate of mutation, sequence alignment, database searching, phylogenetic analysis, bioinformatics tools for analyzing genes, genomes and proteins.

FORMAT: Lecture and Lab

FORMAT COMMENTS: some computer-based labs

LECTURE HOURS PER WEEK: 3

CROSS-LISTING: BIOC 5010

**Course Prerequisites for BIOC 4010:** BIOC 3400, or instructor's consent

**Course Objectives/Learning Outcomes**

Students will be able to:

- conduct sequence alignment, similarity assessment and database searching
- understand the theory and practice multiple sequence alignment using online software

- understand the theory and applications of Hidden Markov Models in bioinformatics
- conduct and interpret phylogenetic analyses using sophisticated computational methods
- understand how high throughput DNA sequencing data is analyzed in biomedical contexts
- understand and use genome assembly algorithms and machine learning approaches
- understand basic protein structural bioinformatics concepts and tools
- write basic programs in the Python scripting language

### Required Course Materials:

**There is no required textbook for this course.** However, the following book provides a good all-around introduction to bioinformatics and is recommended for those with interests in using bioinformatics in their future work:

***Understanding Bioinformatics* by M. Zvelebil and J. O. Baum, (2008) Garland Science (Taylor and Francis Group) ISBN 0-8153-4024-9**

There are several other books at the Killam library which are relevant to parts of the course including: "Fundamentals of Molecular Evolution" (2<sup>nd</sup> edition) by Graur and Li (Sinauer Associates, 2000), Phylogenetic trees made easy by Hall (Sinauer Associates, 2001) and "Molecular evolution, a phylogenetic approach" by Page and Holmes (Blackwell Science, 1998).

### Course Assessment:

	BIOC4010	BIOC5010*
Items		
Examination #1	30%	25%
Assignments	40%	35%
Graduate student project*	--	15%
Examination #2	30%	25%

\*Note: Special Project is an essay written up in the format of a scientific review paper on the use of a particular bioinformatic methods or tool to make inferences about evolution, genomics, biochemical/biological function. Topics will be given in class.

**For BIOC 4010**, conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale:

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (<50)
A- (80-84)	B- (70-72)	C- (55-59)	

**For BIOC 5010**, grades will be converted to Final Letter Grades as above **except that any grade below 70 (B-) will be converted to an F as per FGS regulations**

### Course Policies:

Late assignments will lose 10% of their total mark value every 24 hours after the due date. If a student has a medical reason for a late assignment or missing an exam, they must provide a Student Declaration of Absence form. The standard university policy will be followed: [https://www.dal.ca/dept/university\\_secretariat/policies/academic/misssed-or-late-academic-requirements-due-to-student-absence.html](https://www.dal.ca/dept/university_secretariat/policies/academic/misssed-or-late-academic-requirements-due-to-student-absence.html)

**Schedule of lectures/labs for BIOC 4010/5010 – Bioinformatics (subject to change)**

<b>Date</b>	<b>Course</b>	<b>Instructor</b>
January 8	Intro. to Bioinformatics and pairwise sequence alignment	Andrew Roger
January 10	Pairwise sequence alignment, BLAST	Andrew Roger
January 15	BLAST and Multiple alignments	Andrew Roger
January 17	<b>Lab 1 – Database searching and homology</b>	Sibbald / Roger
January 22	Profiles, Databases, Hidden Markov Models	Andrew Roger
January 24	<b>Lab 2 – Multiple sequence alignments</b>	Sibbald/ Roger
January 29	Hidden Markov Models and Intro to Phylogenetics	Andrew Roger
January 31	Phylogenetics	Andrew Roger
February 5	Phylogenetics	Andrew Roger
February 7	<b>Lab 3 – Phylogenetics</b>	Sibbald/ Roger
February 12	Phylogenetics	Andrew Roger
February 14	<b>Midterm exam</b>	n.a.
February 19	Study break	--
February 21	Study break	--
February 26	Next-generation sequence analysis and biomedical applications 1	Dan Gaston
February 28	Next-generation sequence analysis and biomedical applications 2	Dan Gaston
March 5	Gene prediction and machine learning	Christian Blouin
March 7	<b>Lab 4a – Predicting genes in prokaryotic genomes</b>	Sibbald/ Blouin
March 12	Assembling genomes from a whole lot of DNA reads.	Christian Blouin
March 14	<b>Lab 4b – Predicting genes in prokaryotic genomes</b>	Sibbald/ Blouin
March 19	Assembling genomes from a whole lot of DNA reads.	Christian Blouin
March 21	<b>Lab 5 – Evaluating predictions</b>	Sibbald/ Blouin Sibbald/ Blouin
March 26	Transforming problems: from sequence to 3D structural alignments	
March 28	<b>Lab 6 - Manipulating 3D structure data</b>	
April 5	<i>Ab initio</i> molecular design: the problem of protein structure prediction	Christian Blouin
April 7	<b>Lab 7 – Wrap up</b>	Sibbald/ Blouin

## University Policies and Statements

**This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate**

### Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

**Information:** [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

### Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

**Information:** [https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)

### Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

**Code:** [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

### Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

**Statement:** <http://www.dal.ca/cultureofrespect.html>

### Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) ([elders@dal.ca](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

### Important Dates in the Academic Year (including add/drop dates)

[https://www.dal.ca/academics/important\\_dates.html](https://www.dal.ca/academics/important_dates.html)

### University Grading Practices

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

### Missed or Late Academic Requirements due to Student Absence (policy)

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html](https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html)

## Student Resources and Support

### Advising

**General Advising** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

**Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

### Academic supports

**Library:** <https://libraries.dal.ca/>

**Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

**Studying for Success:** [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

**Copyright Office:** <https://libraries.dal.ca/services/copyright-office.html>

**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

### Other supports and services

**Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness/services-support/student-health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html)

**Student Advocacy:** <https://dsu.ca/dsas>

**Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

### Safety

**Biosafety:** <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

**Chemical Safety:** <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

**Radiation Safety:** <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

**Scent-Free Program:** <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>