

## CS9877 - Research Topics in Genomics and Proteomics / CS4463 - Computational Biology

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### Course description ([course web site](#))

Genomics and proteomics are two rapidly growing areas of molecular biology that are already causing a revolution in medicine. While genomics is concerned with the sequencing and analysis of an organism's genome, proteomics studies the organism's proteome (the entire set of proteins), including protein abundances, variations, modifications, and their interactions with other proteins or DNA. The two fields aim to understand cellular processes and their relation with diseases. The course will provide first an introduction to basic concepts of computational molecular biology, including sequence alignment, dynamic programming, BLAST, spaced seeds, suffix trees, suffix arrays, Markov chains, hidden Markov models, profile HMMs for sequence families, multiple sequence alignment methods, etc. Then, current and emerging research topics will be discussed, with a focus on machine learning techniques for solving protein prediction problems. Topics include: deep learning, Natural Language Processing, attention, text embeddings such as: word2vec, ELMo, BERT, etc., protein embeddings such as: ProtVec, PRoBERTa, MSA-transformer, ESM2, ProtBert, ProtAlbert, ProtT5, etc., protein interaction site prediction, protein-protein interaction prediction, protein structure prediction, protein contact map prediction, etc.

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### Prerequisites

CS9877: None.

CS4463: Computer Science 3331A/B and Computer Science 3340A/B, or Software Engineering 2205A/B and Software Engineering 3310A/B; Biochemistry 2280A is recommended.

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### Instructor

- Prof. [Lucian Ilie](#)
    - Office hours: Wednesdays, 10:30am - 12:30pm, MC378
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### Class time

- Wednesdays, 3:30 - 5:30pm, PAB-36
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### Useful books (not required)

- W.J. Ewens, G.R. Grant, *Statistical Methods in Bioinformatics*, 2nd edition, Springer, New York, 2005.
  - R. Durbin, S. Eddy, A. Krogh, G. Mitchison, *Biological Sequence Analysis*, Cambridge Univ. Press, 1998 (11th printing, 2006).
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## Evaluation -- CS9877/CS4463:

- Participation: **20%**
  - Presentations (given by each student in class): **80%**
    - [Schedule](#)
    - [Evaluation guidelines](#)
  - There will be no assignments or exams
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## Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below. For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at [https://uwo.ca/univsec/pdf/academic\\_policies/appeals/academic\\_consideration.pdf](https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf). The Student Medical Certificate is available at [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

**Absences from Final Examinations** If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

## Accommodation and Accessibility

**Religious Accommodation** When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

**Accommodation Policies** Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf).

## Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, [https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf), the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

**Scholastic offences** are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

## Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.

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