

The University of Western Ontario  
Department of Biology  
Fall 2020

**Biology 4260A: CELLULAR SYSTEMS BIOLOGY**

**1. Course Information**

Systems biology attempts to understand complex biological processes through the use of a holistic, rather than a reductionist paradigm. The course focuses on the use of interdisciplinary systems-level methods to understand both gene regulatory networks and biochemical reaction networks. In addition to providing a theoretical foundation for the study of dynamic biological systems, the course also aims to highlight the practical application of derived models using examples from the current literature. The application of systems-level knowledge to the emerging discipline of synthetic biology will also be discussed. While mathematical modeling forms an integral part of the course, the material presented is both suitable for, and accessible to, fourth year Biology and Medical Sciences students. **Prerequisite(s):** Completion of at least 1.5 Biology courses at the 3000 level or above. Priority to YR 4 HSP modules or Hons DBL Major modules offered by the Department of Biology. **Extra Information:** 2 lecture hours, 1 tutorial/lecture hour, 0.5 course. Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

**2. Instructor Information and Delivery Mode**

<b>Instructor:</b>	Dr. Jim Karagiannis
<b>Office:</b>	BGS 3080
<b>Office Hours:</b>	Thursdays 3:30 - 5:00 p.m.
<b>Phone:</b>	ext. 80975
<b>Email:</b>	jkaragia@uwo.ca
<b>Lectures:</b>	Asynchronous lectures to be posted online
<b>Tutorials:</b>	Asynchronous materials to be posted online

All emails to Dr. Karagiannis must contain "Bio4260A" in the subject line. Students must use their Western (@uwo.ca) email address.

### **3. Course Materials**

Students should visit OWL (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated. Students are responsible for visiting OWL on a regular basis. If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

A textbook will not be used as a learning resource due to the great speed with which the discipline of systems biology has advanced in recent years. Instead, the course will make extensive use of contemporary articles from the field's most respected journals.

### **4. Technical Requirements**

- Stable internet connection
- Computer with working microphone and webcam
- Online Insight Maker account (free)

### **5. Course Objectives and Topics**

To better understand complex biological systems through the identification and characterization of common “design principles” that are conserved throughout evolution and that can be understood using a simple mathematical framework. Topics of study will include:

- Mathematical Foundations
- Introduction to Mathematical Models
- Modelling Chemical Reaction Networks
- Modelling the Cell Cycle
- Transcriptional Networks
- Negative Autoregulation
- Positive Autoregulation
- Feedforward Loops
- Temporal Programs
- Robustness of Protein Circuits
- Optimal Gene Circuit Design

## 6. Learning Outcomes

- Students will develop the mathematical skills needed to describe and analyze biochemical reaction networks and apply these skills within a broader biological context
- Using modelling software, students will be able to construct sets of ordinary differential equations (ODEs) to describe and analyze dynamic biological systems (e.g. cell cycle control systems)
- Students will be able to define a network motif and relate its biological function to selective pressures experienced over evolutionary time
- Students will be able to construct models of common transcriptional circuits (negative autoregulation, positive autoregulation, feedforward loops) and analyze these systems with respect to their temporal and regulatory characteristics
- Students will relate their newly developed knowledge of systems biology to the rational design of synthetic genetic circuits
- Students will be able to critically analyze select, high impact articles from the primary literature and assess their contribution to the continuing development of the discipline of systems biology

## 7. Evaluation

The mark breakdown will be as follows:

<b>Quiz #1</b> (Tues. Sept. 29 <sup>th</sup> , Online OWL quiz):	10%
<b>Quiz #2</b> (Tues. Oct. 20 <sup>th</sup> , Online OWL quiz):	10%
<b>Quiz #3</b> (Tues. Nov. 17 <sup>th</sup> , Online OWL quiz):	10%
<b>Quiz #4</b> (Tues. Dec. 8 <sup>th</sup> , Online OWL quiz):	10%
<b>Modelling assignment:</b>	20%
<b>Presentation</b> (primary research article):	20%
<b>Final Exam</b> (Take-home):	20%

### Accommodated Evaluations

Missed components will be reweighted to the final exam. There will be no "make-up" quizzes.

Please also note that this course adheres to the university-wide descriptors for the meaning of letter grades:

A+	90-100	One could scarcely expect better from a student at this level
A	80-89	Superior work which is clearly above average
B	70-79	Good work, meeting all requirements, and eminently satisfactory
C	60-69	Competent work, meeting requirements
D	50-59	Fair work, minimally acceptable
F	below 50	Fail

## 8. Accommodation and Accessibility

### 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 Academic Accommodation for Students with Disabilities policy 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 Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical

grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Consideration\\_for\\_absences.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf)

and for the Student Medical Certificate (SMC), see:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

### **Religious Accommodation**

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (see [http://www.registrar.uwo.ca/examinations/exam\\_schedule.html](http://www.registrar.uwo.ca/examinations/exam_schedule.html)).

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 Academic Calendar for details (under [Special Examinations](#)).

## **9. Academic Policies**

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

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, 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.

### **Contingency plan for an in-person class pivoting to 100% online learning**

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

**All of the remote learning sessions for this course (if any) will be recorded.** The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

**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).

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

## 8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop 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 Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more.

Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western ([http://www.health.uwo.ca/mental\\_health](http://www.health.uwo.ca/mental_health)) 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>.