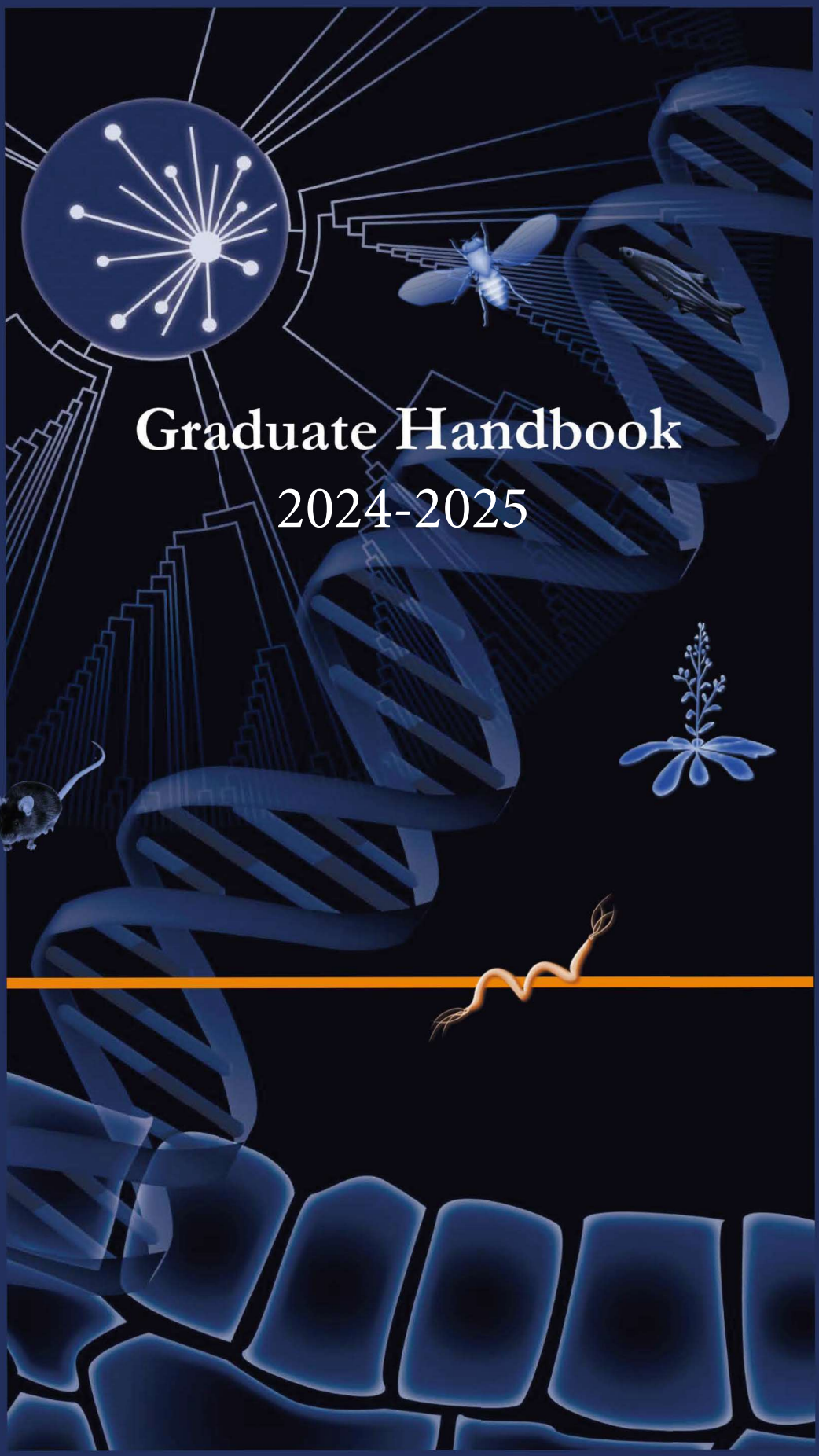
Cell & Systems Biology
UNIVERSITY OF TORONTO



Graduate Handbook

2024-2025

WELCOME

From the Chair...

Welcome to the Department of Cell and Systems Biology at the University of Toronto. I hope you enjoy your time as a graduate student in the department and that you fulfill all of your academic aspirations as you progress through the program. Our department is a very active and dynamic department with research programs focused on studying biological processes at the level of molecules to organisms, from microbes to plants and animals. Our faculty are actively engaged in research across a wide range of sub disciplines in the molecular life sciences including molecular and cell biology, developmental biology, physiology, functional genomics, and systems biology. As such, although your own research may focus on a single area, try to take advantage of the breadth of knowledge and expertise in the department at large to fully round out your graduate educational experience.

This handbook is designed to provide you with information about the Department of Cell and Systems Biology and our graduate programs. Our Program Administrator, Ian Buglass, in the Student Services Office (Ramsay Wright Building, Room 424F, ian.buglass@utoronto.ca) will be happy to provide you with further information on our programs or other aspects of graduate life.

Welcome to the department.

Sincerely,

Nicholas Provart
Chair

From the Cell & Systems Biology Graduate Union (CSBGU)...

The Cell & Systems Biology Graduate Union (CSBGU) would like to welcome you to the Department! The CSBGU is a Graduate Student organization that provides a liaison between the graduate students and the faculty and/or department. As a student government association, we have a constitution, elect officials, and deal with graduate student affairs both within our department and within the university as a whole. We host various social activities throughout the year such as BBQs, parties, and events outside the department. We also organize recreational sporting activities such as dodgeball and volleyball, and sponsor guest speakers at the department. We will encourage you to participate in both the organizational and the recreational side of our association. Together with you, we look forward to a great year.

CSBGU
https://www.csbgu.com/

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Cell & Systems Biology Graduate Union
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OVERVIEW

The Department of Cell & Systems Biology (CSB) is committed to providing a strong graduate program that will train and mentor students in the fields of Cell, Molecular and Systems Biology. The Department of CSB fulfills this commitment by maintaining and enhancing a world-class research, learning and training environment to ensure successful, rigorous, and internationally-recognized graduate education and research. Students undertaking graduate programs in CSB pursue research related to fundamental mechanisms in the growth, development and behaviour of organisms, ranging from unicellular microbes to more complex organisms in the plant and animal kingdoms. Research projects extend from the molecular level to that of whole organisms interacting with each other and their environment.

In keeping with the interdisciplinary nature of the fields in the CSB graduate program, exposure to a breadth of research areas and approaches is a key component of the program. Students have access to state-of-the-art facilities and make use of cutting-edge approaches including functional genomics, genetics, metabolomics, proteomics, bioinformatics, computational biology, cell biology, developmental biology, molecular biology, and physiology. The interdisciplinary and collaborative nature of the research in the Department is fostered through participation in several interdepartmental and interfaculty programs: 1) Collaborative Graduate Program in Developmental Biology; 2) Collaborative Graduate Program in Proteomics & Bioinformatics; and, 3) Collaborative Program in Neuroscience.

The Department of CSB offers both the Master of Science (MSc) and Doctor of Philosophy (PhD) degrees. Students enter the MSc program following successful completion of a BSc, while qualified students may enter the PhD program directly after successful completion of either BSc or MSc degrees. The Department recognizes the importance of the MSc degree as valuable research training for students whose career aspirations may or may not be aligned with proceeding with academic research. MSc students are expected to produce a written thesis that describes original research that is of a quality that is suitable for publication in a peer-reviewed journal. The PhD program aims to produce scientists who will form part of the next generation of independent researchers in cell, molecular and systems biology. In keeping with this, PhD graduates are expected to function as independent scientists and are expected to produce a written thesis that describes original research that is published in the peer-reviewed scientific literature. The CSB graduate program objectives are achieved through:
1) independent research in the laboratories of our Faculty; 2) high level graduate courses; and 3) oral presentations at formal Department seminars and informal group meetings.

The Department of Cell & Systems Biology provides a base stipend for both Canadian and international students. This income is derived from a combination of sources: scholarships and fellowships, teaching assistantships, and a research assistantship from the research supervisor's grant. The Department provides a Teaching Assistant position to all students who are accepted into either the MSc or PhD programs in 2024-2025.

APPLICATION and ADMISSION PROCEDURES

General Information

All applications for admission for graduate studies (MSc or PhD) in Cell & Systems Biology in the Department of Cell & Systems Biology, University of Toronto must be submitted online using the SGS online application, and they are reviewed and approved by the Graduate Studies Committee. For further information, please contact the Graduate Office (Ramsay Wright Building, Room 424F). Instructions for how to complete the online application are available on the CSB website: http://csb.utoronto.ca/graduate-studies/prospective-students/

The normal start date for graduate programs in CSB is September 1st. For this coming year, applications will be accepted beginning November 14th, 2024, over nine months prior to the September 1st, 2025 start date. All application materials (including transcripts, letters of reference, etc.) must be received by February 17th, 2025 in order to be considered for University of Toronto Fellowships for the September 1st, 2025 start date.

Minimum academic requirements for admission

MSc: In addition to fulfilling University of Toronto School of Graduate Studies (SGS) general requirements for admission, applicants must achieve a minimum equivalent of a University of Toronto B+ average in their last year of study in a BSc program, plus minimally a mid-B overall average in the previous year of study.

PhD: Students will be accepted into the CSB PhD program through one of three possible entry routes:

1) Transfer from the CSB MSc Program: Students may reclassify from the MSc program after 12 months of study. Students must reclassify within 20 months of their start date in the MSc program.
2) Following completion of an MSc: Applicants applying from an MSc degree program or equivalent from a recognized university must have an average of A- in their MSc program.
3) Direct entry from BSc: Students with an exceptional record in a BSc program (minimally, University of Toronto A-minus average or equivalent) may apply to be considered for direct admission into the PhD program.

Letters of recommendation

Applicants to the graduate program (MSc or PhD) must arrange for three letters of reference to be submitted online to the Department from three referees who are familiar with the applicant and the applicant's suitability for graduate studies.

English language requirements

All international applicants whose first language is not English are required to obtain a satisfactory score on the Test of English as a Foreign Language (TOEFL). The minimum scores required on the internet-based test are an overall score of 93, with a minimum of 22 in **each** of the writing and speaking sections. The minimum score required on the International English Language Testing system (IELTS) is 7.0, with a minimum score of 6.5 in each component. Exceptions to the minimum English proficiency test score requirements are only granted to applicants who have successfully completed a university degree in a country where English is the primary spoken language, and where the language of instruction and examination was English.

Prospective supervisor

As CSB graduate programs are primarily research oriented, all students accepted in the Department must have a faculty member who is willing to supervise their research and provide financial support. Consequently, **applicants must indicate in their application the names of faculty members who could be prospective supervisors**, faculty by whom they wish to be considered for admission into the graduate program. Applicants should list multiple faculty members as prospective supervisors. Prospective supervisors select graduate students after applications have been submitted.

Selection of successful applicants

Following submission of a complete application, faculty members evaluate the applications from all prospective students. This evaluation may also involve an oral interview of the applicant, either by telephone, Zoom, or in person. After faculty members have identified applicants who they wish to accept as graduate students, the names of these applicants are forwarded to the CSB Graduate Studies Committee (GSC). The CSB GSC reviews these applications, ensuring that the applicants meet minimum requirements, and considers the applicants for Departmental scholarships. If the CSB GSC approves the application forwarded by a prospective supervisor, a letter of offer is sent to the successful applicant. If more than one prospective supervisor indicated that they would be willing to supervise the successful applicant, then the applicant has the opportunity to choose the supervisor with which they would like to undertake their degree program. Successful applicants must indicate that they will accept the offer of admission within a window of time indicated on the letter of offer (generally before the end of March or April in the year of offer). Successful applicants who have accepted their offer then undertake the registration process indicated below.

Borderline Students

If a potential supervisor wishes to consider a student whose undergraduate performance is borderline (B grade, 3.0–3.29/4.0 GPA in their final full year of study, or who do not have a mid-B average over their last 10 FCE's of study), the faculty member must receive the approval of the CSB Graduate Studies Committee to accept the student. The procedure is as follows:

1. The prospective supervisor writes a letter in support of the borderline student for the CSB GSC.
2. The academic ability of the applicant is assessed more closely, paying particular attention to the student's performance on specific courses.
3. Where appropriate, the motivation, self-discipline and academic acumen of the applicant as they relate to the research program is assessed by further recommendation letters or by discussion with the faculty.
4. Where appropriate, the nature of the proposed project, hypothesis, objectives, and length of time for project completion is taken into consideration.

Special Year Students

Students whose grades clearly do not meet the admission requirements are required to take an additional year of 4-5 undergraduate credits. Course selection is determined by the applicant's prospective supervisor and the CSB Graduate Studies Committee. Students are expected to earn **at least a B+ in each of the courses taken in their special year** and upon completion, may then apply to the MSc program. Entry into the program will depend upon commitment from the supervisor and availability of financial support.

Admission to collaborative graduate programs

The Department of Cell & Systems Biology participates in three Collaborative graduate programs: Developmental Biology (MSc or PhD), Genome Biology and Bioinformatics (PhD), and Neuroscience (MSc or PhD). Students can register in these programs after gaining admission to the Department of Cell & Systems Biology. Details pertaining to collaborative graduate programs are provided below in the section entitled "Collaborative Programs".

REGISTRATION and ENROLLMENT

Registration

Continuing degree students and new students with final offers of admission can view their invoice on ACORN (*http://www.acorn.utoronto.ca/*) in late July. New students are emailed registration instructions from the School of Graduate Studies and continuing students are asked to consult the School of Graduate Studies' website at: *https://www.sgs.utoronto.ca/current-students/registration-enrolment/*. Students must register with the School of Graduate Studies and pay/defer fees at the beginning of each academic session. Registration must be completed before students attend classes or otherwise make use of University facilities. A student is considered to be registered as soon as they have paid tuition and incidental fees, or have made appropriate arrangements for deferral of payment. A student's registration is normally for the full year (i.e. from September 1st to August 31st).

Students with a graduate funding package (i.e., scholarships/fellowships, TA, and/or RA, see "Financial Support" below) that covers the minimum first tuition payment can defer their fees using ACORN until they receive some graduate funding. Students are advised to pay the minimum first tuition payment at the bank after receiving their first funding payment in September. Subsequent fellowship installments will have outstanding fees deducted prior to payment of the remainder of the award.

Students with OSAP loans can submit a 'Continuation of Interest-Free Status' form online at: *https://osap.gov.on.ca/OSAPPortal/en/A-ZListofAid/PRDR019241.html* or by submitting a paper application which is also on the OSAP website.

After fee payment or deferral, students are encouraged to contact the CSB Graduate Office during Registration & Enrollment period (September 1st to 10th) if they have any questions about the departmental handbook, graduate courses and enrollment instructions, or if they require any other information. Students are strongly encouraged to set up Direct Deposit on ACORN (*http://www.acorn.utoronto.ca/*) to expedite the payment of fellowship funds.

Orientation for New Students

While each campus may run their own separate orientation activities, all newly registered CSB graduate students must attend an orientation session run on St, George campus during the first week of September. Normally CSB Grad Student Orientation will be coordinated with a social event.

Course Enrollment

Instructions for course enrollment and the graduate course timetable will be available during Registration & Enrollment period. Students are automatically enrolled in the required research/thesis activity but must sign up for any CSB courses on ACORN at *http://www.acorn.utoronto.ca/*. While academic advisors, faculty and staff are available to assist and advise, it is ultimately the student's responsibility to keep their personal and academic information up to date at all times and to follow all University, SGS, departmental and program regulations, requirements and deadlines.

Not all departments will use ACORN for course sign up. Students wishing to take a course offered by another department that is not indicated on ACORN must first ensure that the course choice is acceptable within the context of the degree program in CSB, and then contact the host department to register.

2024-2025 Sessional Dates

M July 15 Registration for Fall session begins
M September 2 Labour Day (University closed)
T September 3 Most formal graduate courses and seminars begin in the week of September 2nd (2)
F September 6 Coursework must be completed and grades submitted for Summer session courses and extended courses (1)
W September 11 Summer Session grades available for viewing by students on the Student Web Service (ACORN)
F September 13 Registration for Fall session ends; after this date, a late registration fee will be assessed (4)
M September 16 Final date to submit Ph.D. theses to SGS to avoid fee charges for 2024-25 (3)
W September 18 Final date to add full-year and Fall session courses (5)
M September 30 Final date for receipt of degree recommendations and submission of any required theses for master's degrees for Fall Convocation and to avoid registration and fee payment for Fall 2024 (6)
M September 30 Final date to submit final Ph.D. thesis for Fall Convocation
Sa September 30 Remaining Fall session fees due by this date to avoid incurring service charges
M October 14 Thanksgiving Day (University closed)
M October 28 Final date to drop Fall graduate courses (0.5 FCE) without academic penalty (5)
November Fall Convocation Information and Dates are posted at: https://governingcouncil.utoronto.ca/convocation, choose "Fall"
Sat November 30 Students registered in Fall-Winter: Remaining Winter session (January-April) fees due by this date to avoid incurring service charges which begin on December 15(4)
T December 24 For last day of classes before Winter break, consult the CSB Graduate Office. The Winter break officially begins on Tuesday, December 24.
M January 6 Most formal grad courses and seminars begin in the week of January 6th (2)
F January 10 Coursework must be completed and grades submitted for Fall session courses (1)
W January 15 Final date to submit PhD theses without fee payment for Winter session (3)
W January 15 Fall Session grades available for viewing by students on the Student Web Service (ACORN)
F January 17 Final date for registration of students beginning program in Winter session; after this date, a late registration fee will be assessed (4)
M January 20 Final date to add Winter session courses (5)
F January 24 Final date for receipt of degree recommendations and submission of any required theses for March or June graduation for master's students without fees being

	charged for the Winter session [6]
F January 24	Final date for all students to request that their degrees be conferred *in absentia* in March
F January 24	Final date to submit final doctoral theses for March convocation *in absentia*
F January 24	Fall dual registrants must be recommended for the master's degree by this date to maintain their PhD registration [6]
F February 28	Final date to drop full-year or Winter session graduate courses (0.5 FCE) without academic penalty [5]
March	March Graduation *In absentia* Information is posted at: https://governingcouncil.utoronto.ca/convocation, choose "March *in absentia*"
F April 11	Final date for receipt of degree recommendations and submission of any required theses for master's degrees for June Convocation [6]
F April 11	Final date for submission of final doctoral thesis for students whose degrees are to be conferred at the June Convocation [3]
F April 11	Final date for degree recommendations of Winter dual registrants for the master's degree to maintain their PhD registration [6]
F April 11	For students obtaining degrees at June Convocation, course work must be completed and grades submitted for full-year and Winter session courses
May	For first day of summer classes, consult the CSB Graduate Office.
F May 2	Final date for registration for May session
F May 9	Course work must be completed and grades submitted for full-year and Winter session courses (except for extended courses) [1]
M May 12	Final date to enroll in May-June or May-August session courses [5]
W May 14	Winter Session grades available for viewing by students on the Student Web Service (ACORN)
M June 2	Final date to drop May/June F section courses without academic penalty [5]
June	June Convocation Information and Dates are posted at: https://governingcouncil.utoronto.ca/convocation
M June 23	Final date to drop May-August session Y section courses without academic penalty [5]
M July 7	Final date to enrol in July-August courses [5]
F July 11	Coursework must be completed and grades submitted for May/June F Section Courses [1]
W July 16	Grades for May/June F Section Courses available for viewing by students on the Student Web Service (ACORN)
M July 28	Final date to drop July-August S section courses without academic penalty [5]

[1] Graduate units may establish earlier deadlines for completion of course work and may prescribe penalties for late completion of work and for failure to complete work, provided that these penalties are announced at the time the instructor makes known to the class the methods by which student performance shall be evaluated.
[2] The precise dates of commencement of courses are determined by the graduate units; students are urged to contact the relevant graduate units for information. SGS maintains a 13-week graduate instruction period; however, if a course does not fall into the traditional 13-week period, the graduate unit will inform students of important dates and deadlines in the course syllabus.
Note: Graduate students may only enroll in undergraduate courses with the approval of their supervisor or graduate unit. Students are responsible for meeting the deadlines and requirements of the undergraduate course as presented in class and in the undergraduate division's calendar. Graduate students will be graded under the graduate grading scale. Students should consult the undergraduate Arts and Science Calendar for enrolment and dates.
[3] A final thesis is the corrected, approved version of the thesis which is submitted to SGS following the Final Oral Exam
[4] Students are considered registered when they have paid tuition and non-tuition fees or when they have completed the register without payment process (fee deferral). Status will change from "Invited" to 'Registered" on ACORN.
[5] Graduate units may establish earlier deadlines to add/drop courses, but these dates must be clearly communicated to students. Please note that the last date to cancel a course or registration with no academic penalty is not the same as the last date to be eligible for a refund.
[6] For final dates for completing degree requirements, students should consult their own departments.

GENERAL CSB GRADUATE PROGRAM REQUIREMENTS

Expected progress through program		
	MSc	**PhD**
Year 1	• CSB1020H - 1-2 modules or equivalent (0.5 FCE) • CSB1010Y/Y - MSc Seminar series (CR/NCR, includes attendance at 24 departmental seminars) • Supervisory committee meetings (2) • MSc Thesis research	• CSB1020H - 1-2 modules or equivalent (0.25-0.5 FCE) • CSB1011Y/Y - PhD Seminar series (CR/NCR, includes attendance at 24 departmental seminars) • Supervisory committee meetings (2) • PhD Thesis research
Year 2	• CSB1010Y/Y - MSc Seminar series (CR/NCR, includes attendance at 24 departmental seminars) • Supervisory committee meeting • MSc Thesis research completed & thesis written • Public presentation of thesis research • MSc Thesis defense	• CSB1020H - 1-2 modules or equivalent (0.25-0.5 FCE) • CSB1011Y/Y - PhD Seminar series (CR/NCR, includes attendance at 24 departmental seminars) • PhD Thesis proposal (combined with supervisory committee meeting) • PhD Thesis research
Year 3	---	• CSB1020H - 1-2 modules or equivalent (0.25-0.5 FCE) • CSB1011Y/Y - PhD Seminar series (CR/NCR, includes attendance at 24 departmental seminars) • Supervisory committee meeting • PhD Thesis research
Year 4	---	• CSB1011Y/Y - PhD Seminar series (CR/NCR, includes attendance at 24 departmental seminars) • Supervisory committee meeting • PhD Thesis research completed & thesis written • PhD Thesis approval committee meeting • Public presentation of thesis research • Final oral examination

GENERAL PROGRAM REQUIREMENTS: DETAILS

Supervisory Committee

Composition of Supervisory Committee

It is a requirement of the School of Graduate Studies that a Supervisory Committee be established for all registered students in order to guide their progress in the program. Every graduate student in the department must have a Supervisory Committee consisting of three faculty members (including the Supervisor) from the University. In CSB graduate programs, the minimal composition of the Supervisory Committee can be the student's Supervisor who is a member of the CSB Graduate Faculty, one faculty member whose ***primary*** appointment is with the Department of Cell & Systems Biology, and one appropriate faculty member who is a member of University of Toronto School of Graduate Studies graduate faculty. Additional unofficial members from outside the University may be appointed with approval from the Graduate Studies Committee. Where co-supervision exists, two supervisory committee members, in addition to the co-supervisors, are required, with at least one of these members having their ***primary*** appointment with the Department of Cell & Systems Biology. The selection of Supervisory Committee members is the responsibility of the student's supervisor, but the choice should be done in consultation with the graduate student.

Role of Supervisory Committee

The Supervisory Committee must play a prominent role in establishing the student's course work and research program. Responsibilities of the Supervisory Committee include: attendance at supervisory committee meetings, PhD proposal exams and thesis defense evaluations and examinations, evaluating and assessing the student's progress, and making recommendations.

Nomination of Supervisory Committee

The Supervisory Committee must be nominated by the supervisor as soon as possible after the student's arrival in the Department, and committee names submitted to the CSB Graduate Office for approval. The selection of Supervisory Committee members is the responsibility of the student's supervisor, and done in consultation with the graduate student. It is the supervisor's responsibility to contact potential members and get their approval before recommending names to the Graduate Office.

Supervisory Committee Meetings

Occurrence and Purpose

The CSB Graduate Program requires that the Supervisory Committee meet as follows regardless of whether the student is enrolled in the MSc or PhD program:

1) ***First Supervisory Committee Meeting*** - ***before the end of month 4*** after the graduate student has initiated their graduate program
2) ***Second Supervisory Committee Meeting*** - ***before the end of month 10*** of the graduate student's degree program
3) ***Subsequent Meetings*** - **at least once a year during the rest of the student's program.**

The PhD Transfer/Proposal Examination Meeting can substitute for a Supervisory Committee meeting if agreed by the members of the Supervisory Committee. In order to be eligible for graduate funding packages, a student must have their required Supervisory Committee meetings for recommending changes and, if necessary, recommending the termination of the student's enrolment.

In addition to the research project, the Supervisory Committee should discuss the student's program requirements, with the following points in mind: missing background in a topic crucial to the project; scheduling of the PhD proposal within the first 12-18 months of the program; and the length of the program.

Fall term Supervisory Committee meetings must be held no later than mid-December and Spring term meetings no later than June 30th. Each student is responsible for scheduling his/her own Supervisory Committee meeting in consultation with the supervisor and members of the Supervisory Committee. We highly recommend that students set up Doodle polls to agree on all committee meeting dates and times (*http://www.doodle.com/*). *When2meet* is an option that faculty find even more effective than Doodle polls.

Student's Written Progress Report for Supervisory Committee Meetings

For each committee meeting, the student must prepare a written report of their progress and future plans.

Students must send the **completed** Fillable CSB Supervisory Committee Forms and updated CV with their meeting report to all members of the committee a ***minimum of three business days*** before the Supervisory Committee Meeting. Failure to provide the report within the required timeframe may result in cancellation of the Supervisory Committee Meeting, and/or the student given notice for failing to complete program requirements.

The report should be a ***maximum of 10 double-spaced, letter-size pages, not including references or figures***, although the length of the report will increase as the student progresses from year to year. The report can be double sided.

The report should normally contain the following elements:

- brief introduction to the research topic, including relevant literature and requisite background information
- hypotheses and/or objectives of the research
- results to date
- figures and/or tables with useful captions should be used where appropriate
- where relevant this should include a description of the methods used
- discussion of results, including implications for future work
- future work plan, including concise timetable (Gantt chart preferred) for completion of future work

Structure of the Supervisory Committee Meeting

A member of the Supervisory Committee other than the supervisor, who is a faculty member in the Department of Cell & Systems Biology is designated Chair of the Supervisory Committee Meeting. The Chair of the Supervisory Committee Meeting runs the Supervisory Committee

Meeting, ensuring that it conforms to the format outlined below, and that the necessary committee forms are completed. The Chair of the Supervisory Committee Meeting also functions as a conduit for communication between the Supervisory Committee and the CSB Graduate Studies Office.

At the beginning of the Supervisory Committee Meeting, the student is asked to exit the room for the Supervisory Committee to briefly discuss the student's progress and the nature of the upcoming meeting.

The student is then invited back into the room to provide a ***20 minute presentation*** based on a brief written progress report of work completed since the last meeting, and an outline of future research plans.

During the Supervisory Committee Meeting, the Supervisory Committee discusses with the student the outcome of the student's research, the student's plans for future research, and the student's progress against schedule to meet program objectives including completion of the thesis. The Supervisory Committee also discusses the student's background knowledge with the aim of ensuring that the student is gaining the requisite knowledge to complete their degree program and defend their thesis. The Supervisory Committee uses the discussions as the basis for providing advice and guidance, and to make recommendations to address any deficiencies in research progress or background knowledge if necessary.

Following the period of discussion in the Supervisory Committee Meeting, the student is asked to exit the room for the committee to confer and discuss the outcome of the meeting. Following this, the student is invited back into the room and the Supervisory Committee Meeting Report Form must be completed in its entirety by the supervisor, and signed by each member of the Supervisory Committee. The student may add comments to the completed form and must sign it before submitting to the Graduate Office. A copy of the student's progress report is to be attached to the form. **Students should also keep a copy to bring to subsequent meetings.**

At the end of the Supervisory Committee Meeting, the student remains behind with the Chair of the Supervisory Committee Meeting after the other Supervisory Committee members, including the supervisor, depart. The student is asked about their perception of the Supervisory Committee Meeting, and whether they understand all that was communicated by the Supervisory Committee in the meeting. The student will also be asked if they have all the resources they require to complete their graduate work, and if there are any other issues regarding their graduate student experience that need to be resolved. The intention of this discussion is for the student to outline any concerns that the student may have, allowing the Supervisory Committee Chair to function in a supportive manner for the student, and, if need be, to provide advice for conflict resolution or for dealing with other issues. The Supervisory Committee is also intended to provide student support when needed as well.

Note: If there are any serious issues that the supervisor or student wish to address during the Supervisory Committee Meeting, the option exists for either the student or their supervisor to approach the Supervisory Committee Chair in advance of the meeting to bring these issues to the attention of the Supervisory Committee Chair, and discuss how these issues might best be dealt with in the context of the Supervisory Committee Meeting.

Course Work

Graduate courses, in the form of quarter-credit (0.25 FCE) modules as outlined in the sections below, are a graduate program requirement for all students in Cell & Systems Biology. The modules taken by an individual student should be selected in consultation with the Supervisor in the first term, and with the Supervisory Committee thereafter, and should be those most suitable for providing an academic background for the thesis research. MSc students should try to complete their course requirements by the end of their first year; whereas, PhD students must complete theirs before the end of their third year of study. The department will adhere to the grading practices and grade requirements for successful completion of courses, which are set by the School of Graduate Studies.

Six-week modules will constitute one quarter-credit course offering. A student uses the Student Web Service to register for specific sections of the standard CSB course code CSB1020H (or CSB1021H). A grade is entered by the course instructor(s) after the specific module has been completed. Students must enroll in modules at the beginning of the session that the module is offered, and must note the last day to add or drop courses for each session (courses must be dropped before the course is over 50% complete). These dates are posted on pages 6 and 7 of this handbook, in addition to being posted on the SGS website at:
https://www.sgs.utoronto.ca/current-students/sessional-dates/

Most modules are seminar-based modules that are 6 weeks in duration, with 2 hours devoted to the module per week. The weekly meetings generally comprise a combination of student seminars and discussion of the seminar topics. In contrast to the seminar-based module, several modules are offered as workshop-style modules over a compressed timescale. Workshop-based modules are primarily focused on practical aspects of cell, molecular and/or systems biology.

Some modules will emphasize new techniques, technologies or approaches, and how these are applied to research problems, whereas others focus on fundamentally important concepts in cell, molecular and systems biology. Modules serve three main objectives: i) to develop an awareness of current progress in research, including important mechanistic insights into biological organisms, as well as cutting-edge techniques, approaches and technologies in cell, molecular and systems biology, ii) to develop abilities in interpreting and criticizing scientific approaches and data, iii) to improve writing and/or verbal skills.

Research Seminar Attendance

All students will be enrolled in a “continuous” seminar series (CSB1010Y/Y for MSc students, CSB1011Y/Y for PhD students) that lasts for the duration of their degree program. The seminar series is for “credit only” and is not graded. Successful completion of the seminar series involves the student attending on average, one seminar per week during each 12-week term, for each of the autumn (September-December) and winter (January-April). It is anticipated that the majority of this requirement will be fulfilled by attendance at departmental seminars at the student’s home campus, but may include seminars offered at other campuses, in other departments, or at other institutions. The mixture of seminars attended by a student will be decided in consultation with the supervisor and supervisory committee and set at the beginning of each term. It is the supervisor’s responsibility to function as a positive role model in the attendance at seminars and to monitor their students’ attendance at seminars. If a student does not attend the requisite number of seminars, the student risks not receiving credit for this program requirement.

The seminar series is composed of invited guest lecturers, seminars by post-doctoral fellows in the Department, and the presentation component of the MSc thesis defense and the public PhD thesis presentation seminar that precedes the School of Graduate Studies (SGS) PhD Final Oral Examination (FOE). The number of seminars that students are required to attend will be established and announced in September.

CSB PhD Proposal/Transfer Examinations are held periodically from the beginning of October through April of each academic year. The examinations include 25 minute public seminars presented by MSc students transferring to the PhD program, and second year PhD students. In each instance, the students are presenting proposals for their future PhD research, and are completing one of the requirements for either transfer into the PhD program or continuation in the PhD program respectively. See page 19 (transfer exams) and pages 21-25 (proposal exams) for more details. Students are expected to attend these seminars at their respective campus.

Thesis Research

Original research and the completion and defense of a thesis are requirements for students in both the Master's and Doctoral programs in the graduate program in Cell & Systems Biology.

MSc PROGRAM REQUIREMENTS

General Program Requirements

The CSB MSc program should be completed within 20 months (5 sessions). Students in the MSc program must complete two CSB1020H modules (0.5 full course equivalent, FCE) or approved equivalent, the CSB1010Y/Y MSc seminar series (CR/NCR, attendance at a minimum of 24 seminars per year), a thesis on a research project, a public presentation of the thesis research, and defense of the thesis at an oral examination.

Course Work

Students in the Cell & Systems Biology MSc program are required to successfully complete ***two modules (i.e., 0.5 FCE) or one half-credit course***, preferably in the first year of study, with a ***minimum grade of B-*** in both modules.

Provided MSc students fulfill their module requirements, they are welcome to take additional courses (including those that are not modular) offered by CSB and other graduate units. The student's Supervisory Committee may also recommend that additional courses be taken. The CSB Graduate Studies Committee seeks to provide students with flexibility in taking graduate courses, particularly if they are in excess of the basic requirements, and will work to find solutions for students wishing to take courses from other departments.

MSc Thesis Exam

Arrangements for the MSc thesis exam are made by the Program in Cell & Systems Biology on behalf of the School of Graduate Studies. Please check with the Graduate Office for any deadlines (course marks or thesis submission) required for convocation and *http://csb.utoronto.ca/graduate-studies/current-students/forms/* for "MSc Thesis Examination Guidelines". The examination will be based on the assessment of the thesis containing the results of an original research study and the ability of the candidate to defend the thesis and show a mastery of the research topic. The candidate must demonstrate that he/she understands the topic, can defend the data and the conclusions presented in the thesis, and can place the findings in a general context. There are two components to the MSc Thesis Examination: 1) a public presentation of the MSc thesis, and 2) an *in camera* defense of the MSc thesis.

Composition of the Examination Committee

The MSc Thesis Examination Committee is composed of the supervisor, two examiners who are members of the candidate's Supervisory Committee, and one examiner from outside the supervisory committee within your discipline who can be a CSB graduate faculty member or be Graduate Faculty in another department at the University of Toronto. Student and supervisor should jointly recommend the examiners. One of the two committee members will serve as Chair of the examination. The M.Sc. candidate and/or supervisor can suggest to the CSB Graduate Office which committee member will serve as Chair of the examination. If one of the supervisory committee members is unavailable to serve as an examiner, that member can be replaced with another examiner within your discipline. The appointment of the final examining committee is at the discretion of the CSB GSC. After the approval of the MSc Thesis Examination Committee, student and supervisor should recommend a possible date for the examination after consulting the examiners for availability. When scheduling the exam, copies of the thesis must be submitted to all committee members, along with a copy of the "Approval of

Thesis" form, at a minimum of two weekends before the examination date. The Graduate Administrator will confirm the exam date and time with the student and/or supervisor, and circulate the formal announcement to participants. Students are responsible for booking room(s) and their own audiovisual equipment needs.

The MSc Thesis

MSc theses should address non-trivial hypotheses using observational, theoretical or experimental methods which yield results that are of publication quality and rigour, but may not necessarily constitute a complete, publishable entity. When writing the thesis, consult the "Producing Your Thesis" section of the School of Graduate Studies website at:
https://www.sgs.utoronto.ca/current-students/program-completion/producing-your-thesis/

Adhere to the following general guidelines:

- A general introduction and a general discussion at the beginning and the end, respectively, should serve to tie the chapters together.
- Tables and figures (plates may be an exception) should be dispersed throughout the text as appropriate, not grouped at the end of a chapter as for a submitted manuscript.
- If the thesis contains published or soon to be submitted material, this should be explained giving the reference(s) in a statement at the beginning of the thesis. It should also be made clear whether a chapter differs in any way from the publication (e.g., an expanded discussion). If the publications include authors other than the supervisor(s), this statement should also explain the contribution of the other author(s). Candidates should also refer to the section on Previously Copyrighted Material in the guidelines.
- Use common sense. A thesis should be viewed as a coherent complete work. It should not frustrate reviewers by having too many things repeated in each chapter (a common complaint) or by the need to search for figures and tables or references which are not rationally placed.

After the thesis is completed, the candidate's supervisor must sign the "Approval of thesis" form. This indicates that elementary rules of the usage of English have been followed, and the text is free, or near free, of typographical errors. The supervisor's signature also indicates that tables, figures and references are correctly annotated, the departmental guidelines for theses have been followed, and the departmental examination can take place. The form should be included with the thesis that is distributed to all examination committee members. Failure of the supervisor to sign and return the form to the Graduate Office or failure of the candidate to deliver the thesis two Fridays before the exam could result in the Associate Chair for Graduate Studies canceling the examination. Arrangements for the examination may also be cancelled if one or more of the examiners find the thesis unsuitable for examination within one week of receiving the thesis.

Responsibilities of the Examiners

Each examiner should evaluate the thesis. The scientific qualities of the work which is presented should be associated with published studies in refereed journals. The standards of quality which are imposed should be equivalent to those of a peer review. The examiners must be satisfied that the study was performed with care and that appropriate controls were used where necessary. The interpretations of the results should be consistent with the data presented. The candidate is expected to contextualize their results relative to other research conducted on the same or related topics. This should include a literature review and an assessment of the results in relation to the findings from relevant studies.

It is essential that prior informal discussions between examiners should not occur in order to allow for a fair academic assessment, made without prejudice at the time of the examination. The oral examination is a formal event, not an informal discussion with the candidate.

Conduct of the MSc Thesis Examination

There are two components to the MSc Thesis Examination: 1) a public presentation of the MSc thesis, and 2) an *in camera* defense of the MSc thesis. The two components of the thesis must be completed within two (2) months of each other.

Public Presentation of the MSc Thesis

Ideally, the public presentation takes place immediately before the *in camera* defense, but this is not obligatory and the two may be separated in time. Regardless of the scheduling of the public presentation of the MSc thesis, the presentation must take place before the final submission of the thesis. The presentation is a MSc program requirement, and the SGS Degree Recommendation Form will not be signed until the presentation is completed.

The pubic presentation of the MSc thesis can potentially be made during the departmental seminar series on the student's home campus with members of the department and the MSc Thesis Examination Committee in attendance. It is the role of the student to schedule the public presentation of their thesis by conferring with the Departmental Seminar Committee Chair on their home campus well in advance of their defense date (e.g., two-three months). In the event that it is not possible to schedule the public presentation of the defense in the Departmental Seminar Series, the public presentation of the thesis can be scheduled outside of this time.

In the public presentation of the thesis the student presents a 25-minute seminar providing requisite background information, the hypotheses they tested, their thesis results, and the interpretation thereof. A computer-based presentation format (e.g., Powerpoint, Keynote, Acrobat, Quicktime, Flash) should be used. Students should bear in mind that the presentation level and format should be understood by most members of the department, not just the supervisory committee. Students should be prepared to take questions from the audience following their seminar. The seminar chairperson should restrict questions to 5 minutes maximum.

Defense of the MSc Thesis

Up to three observers may attend the *in camera* MSc thesis examination, subject to the approval of the Chair of the Thesis Examination Committee and the candidate. The observers can be anyone who would like to attend the examination, and could include friends and members of the candidate's family. The observers must be solely observers, and not disrupt the examination in any way.

The candidate and any observers are asked to wait outside the examination room until the Thesis Examination Committee has convened and conferred on the nature of the impending defense. The Thesis Examination Committee Chair will then invite the candidate into examination room. In the event that the candidate completed the public presentation of their thesis immediately before the MSc Thesis Defense, the questioning of the candidate can begin immediately. In the event that some time has transpired between the public presentation and the thesis defense, the candidate may be asked to verbally recapitulate the highlights of their thesis in approximately 10-15 minutes, without visual aids.

The Thesis Examination Committee Chair will then invite each of the examiners to question the student on the contents of the thesis and the seminar. Each examiner should question the student for approximately 20-30 minutes. General background questions that do not have significant, direct relevance to the subject matter of the thesis should be avoided in the early stages of the examination although questions of this type may be relevant later. Examiner's editorial comments should not be discussed at the oral examination. It is recommended that each examiner hand the student a list of any comments for the final revision of the thesis after the examination. The Chair should guard against any tendency of examiners to argue with each other instead of concentrating on the exam. The examination, including the seminar, should not exceed two hours. The candidate and any observers must leave at the conclusion of the examination during the discussion of the defense and voting by committee members.

Immediately after the candidate and any observers have withdrawn, the Chair will initiate a discussion on the quality of the thesis and the performance of the candidate. Examiners are required to vote on the following recommendations:

- The candidate has satisfied the examiners on his/her performance at the oral examination and quality of the thesis subject to any editorial changes which may be required.
- The candidate has satisfied the examiners on his/her performance at the oral examination and the quality of the thesis subject to minor corrections to the thesis.
- The candidate has satisfied the examiners on his/her performance at the oral examination and the quality of the thesis subject to minor modifications to the thesis.
- The overall performance (thesis and/or oral) is judged unacceptable and a re-examination (thesis and/or oral) is necessary.

Editorial corrections refer to typographic or inaccuracies in Tables, Figures, References or the text. Minor corrections include the above and minor grammatical or syntactical changes that aim to clarify the meaning. Minor modifications include minor changes to content rather than editorial changes. The supervisor will ensure that such corrections or modifications are made satisfactorily.

In the event of one (or more) examiners abstaining or casting a negative vote, the Thesis Examination Committee Chair will rule whether the candidate has passed the examination. It is anticipated that this situation will only arise when a candidate has been re-examined. No more than one reexamination is permitted. The student will not have to present another public seminar in the event of a reexamination. The reexamination should take place no sooner than two months and not later than six months from the date of the first attempt. In the event of a fail, the student is required to withdraw from the program. Should examiners fail to achieve unanimity, the Chair must bring the matter to the attention of the Associate Chair for Graduate Studies as soon as possible.

As soon as possible, the candidate is asked to return to the exam room to learn the outcome. The Chair of the exam will identify major strengths and weaknesses and detail the required changes to the thesis. The supervisor is personally responsible for ensuring that the required editorial corrections or minor changes are completed within four weeks of the date of the examination and that the Graduate Office is informed of the completion of the final thesis by submitting the “Approval of Thesis Following the Departmental Examination” form.

After the Associate Chair for Graduate Studies has determined that the degree requirements have been met and has signed the MSc Degree Recommendation form, the student submits an electronic copy of the thesis on the ProQuest Digital Library.

Instructions on how to prepare, format, convert to PDF, and submit an electronic thesis (ETD) to the ProQuest Digital Library Repository are available on the following SGS Web page:
https://www.sgs.utoronto.ca/current-students/program-completion/producing-your-thesis/

Frequently asked questions about electronic theses can be found at:
https://www.sgs.utoronto.ca/academic-progress/program-completion/faqs-etds/

TRANSFER FROM MSc TO PhD PROGRAM

Students wishing to initiate a transfer from the MSc to the PhD program should submit a "PhD Transfer/Proposal Examination Pre-Approval Form" and have it co-signed by their supervisor. This should be submitted to the CSB Graduate Office before the end of the student's first year in the program. The student will then register in the PhD program in their second year of the graduate program and the PhD transfer examination (along with a public presentation) will be scheduled between October and March.

The outcome of a PhD transfer examination will be either: pass and proceed in the PhD program or fail and complete an MSc by the end of 24 months.

Transfer students are required to take ***four*** modules (**i.e., 1.0 FCE**), and obtain a minimum grade of **B-** in all modules completed. Any course work completed prior to the transfer may count toward this total. The base stipend is provided for a total of five years, starting with the date of first entry in the graduate program.

Full details about the composition of the transfer examination committee, the written report, and the oral presentation can be found under the heading "PhD Proposal Exam" on pages 21-25 of this handbook. The transfer exam procedures are the exact same as those for a PhD proposal examination.

DIRECT ENTRY TO PH.D. PROGRAM

The Program in Cell & Systems Biology encourages direct entry to the PhD program from a BSc degree for exceptional students with a minimum A- average in the final year. Applicants should discuss the possibility of direct entry to a PhD with their potential supervisor(s). See pages 20-29 for PhD program requirements.

PhD PROGRAM REQUIREMENTS

General Program Requirements

Students entering the PhD program following transfer from the MSc program should complete the PhD program within 5 years from the start date at which they enrolled in the MSc program. Students entering the PhD program directly from a BSc program should complete the PhD program within 5 years. Students entering the PhD program following completion of an MSc degree should complete the CSB PhD program within 4 years.

Students in the PhD program must complete four quarter-credit modules or equivalent (1.0 FCE), the CSB PhD seminar series (credit only, minimum 24 seminars per year), a thesis on a research project, a public presentation of the thesis research, and defense of the thesis at the final oral examination.

All PhD students and MSc students wishing to reclassify as PhD students must successfully complete a PhD Proposal/Transfer Examination. The PhD Proposal/Transfer Examination involves three components: 1) preparation of a written research proposal; 2) seminar to the department and questioning by the public at a Departmental PhD Proposal/Transfer presentation; and, 3) *in camera* questioning by a PhD Proposal Examination Committee immediately following the presentation. Proposal/Transfer examinations should be held between October and March in the second year of the graduate program. (Students transferring from the MSc to the PhD program may want to consult with the CSB Graduate Office and their supervisor about the timing of the examination, because student funding packages will vary, based on the month/session that the transfer exam is held.)

Students that transfer from the CSB MSc program to the PhD program may apply course credits earned as CSB MSc students toward their PhD course requirements. Students entering the PhD program following completion of an MSc will have to complete all of the PhD program course requirements.

Ph.D. candidates complete a final committee meeting (Thesis Approval Meeting) for approval to proceed to the School of Graduate Studies' Final Oral Examination. The School of Graduate Studies' Final Oral Examination is immediately preceded by a public seminar presentation of the thesis.

Course Work

Students in the Cell & Systems Biology PhD program are required to successfully complete ***four modules***, or equivalent, with a ***minimum grade of B-minus*** in all modules. All modules must be completed by the end of the 3rd year of study. It is highly recommended that at least one of the modules be taken in the 1st year of study and at least one be taken in the 2nd year of study, with the remaining two modules taken at any time in the student's program, provided all four modules are completed before the end of the third year of the student's program.

A minimum of 0.5 FCE of the 1.0 FCE required in the CSB PhD program must be taken from those modules/courses offered by the Department of Cell and Systems Biology. That is, to meet their four-module requirement, PhD students may take only two modules, or equivalent (i.e., 0.5 FCE), offered by a department other than CSB (e.g., Molecular Genetics, Biochemistry), and this must be approved by the student's Supervisory Committee and the CSB GSC. The other 0.5 FCE could also be made up by taking a one term course offered by another department, but this must be approved by the student's Supervisory Committee and the

CSB GSC.

The Supervisory Committee will evaluate course work of PhD applicants to determine if additional courses are required. Students who transfer from the CSB MSc to the CSB PhD program may count any course work completed prior to the transfer toward their PhD course requirements. It is anticipated that some PhD students will continue to participate in seminar-based modules after their minimum requirement is completed. Provided PhD students fulfill their course requirements as outlined above, they are welcome to take additional courses (including those that are not modular) offered by CSB or other graduate units. The student's Supervisory Committee may also recommend that additional courses be taken. The CSB GSC seeks to provide students with flexibility in taking graduate courses, particularly if they are in excess of the basic requirements, and will work to find solutions for students wishing to take courses from other departments.

PhD Candidacy

Doctoral students are subject to the SGS policy on "Timely Completion of Graduate Program Requirements". A PhD student at the end of year three (year four for direct-entry students) is expected to have completed all program requirements exclusive of the thesis. Once completed, the notation *Candidacy Achieved* will appear on the students' transcript.

PhD Proposal Exam

The Proposal Examination must be held within the first 13-20 months of entry into the PhD program. The purpose of the Proposal Examination is to ensure that the research proposal is sound and that the study has every expectation of being completed within the time indicated. It also serves to determine if the student has sufficient knowledge in the field to pursue the proposed research. It provides a forum for discussion and suggestions from members of the department that may enhance the quality of the work and the achievements of the student.

The PhD Proposal Examination involves three components: 1) preparation of a written research proposal; 2) presentation to the department and questioning by the public at a Departmental PhD Proposal / Transfer seminar; and, 3) *in camera* questioning by a PhD Proposal Examination Committee immediately following the public presentation. Please check the CSB website (*http://csb.utoronto.ca/graduate-studies/current-students/forms/*) for "PhD Proposal Examination Instructions".

The emphasis at the proposal examination will be on the theory and proposed approach, rather than on progress to date. The PhD Proposal Examination may serve as a Supervisory Committee meeting for that term, subject to agreement between the student and Supervisory Committee.

The Graduate Office will remind PhD students that a proposal is due and will request that the students make arrangements to schedule the Departmental PhD Proposal/Transfer seminar and examination. The student should give the title of their talk, an abstract, and a list of committee members to the Graduate Administrator at least two Fridays before the presentation / examination. Failure to provide the information within the required timeframe can result in the student being prohibited from undertaking the PhD Proposal Examination.

Composition of the PhD Proposal Examination Committee

The PhD Proposal Examination Committee will have **five** (5) **members**. Four of the members of the Proposal Examination Committee are appointed by the student and supervisor, and approved by the CSB Associate Chair for Graduate Studies. These four members are as follows: the supervisor; two members of the candidate's supervisory committee (at least one of which must hold their primary faculty appointment in CSB); and one graduate faculty member who has SGS graduate faculty status or equivalent, who has not collaborated with the supervisor, and who can be from either CSB or from a department other than CSB. **These four members must be in attendance in order to fulfill SGS requirements for quorum. An additional member who holds a graduate appointment with CSB can be invited to join the PhD Proposal Committee to ensure that quorum is met.**

The **fifth member of the PhD Proposal Examination Committee will be the non-voting Chair of the PhD Proposal Examination Committee, appointed by the CSB Graduate Office**. The fifth member will be a graduate faculty member from CSB, who is not a member of the student's Supervisory Committee, and who has served in some capacity for a previous or current Graduate Studies Committee (e.g., Examination Chair, Examination Committee Member, etc.). The Chair of the PhD Proposal Examination is a non-voting member of the committee.

Written Report and Presentation for the PhD Proposal Examination

At least two Fridays prior to the PhD Proposal/Transfer Examination, the student should provide committee members with a written report. **Failure to provide the PhD Proposal report within the required timeframe can result in the student being prohibited from undertaking the PhD Proposal Examination.**

WRITTEN REPORT

Format:

- Recommended length of 3,000 - 5,000 words, not including abstract, figures, tables, legends and references.
- Font 12-point Times New Roman or 11-point Arial.
- Double or 1.5 line spacing, pages numbered.
- Use active voice whenever possible.
- Figures & tables can be either included in-line with text or at the end.

Sections:

1. Title, name, abstract, list of abbreviations:
    - Abstract is approximate 200 words in length.
        - Your abstract should summarize all aspects of your proposal.
        - Avoid excess jargon when possible.
2. Introduction & Literature Review:
    - Introduction to the research topic
        - Place your work into a broader biological context using language appropriate for an educated but non-specialized audience.
    - Relevant background literature
        - Discuss important background, key developments, and relevant controversies.
        - Cite primary sources where possible. Do not simply cite review papers.
    - Overall goal and objectives
        - Objectives are questions you want to answer.

    - You can have both long-term and short-term objectives to help position your work within the larger biological problem.
    - Note that objectives are different than aim. The former are biological questions, while the latter are methodological approaches.
    - State your objectives clearly and unambiguously, e.g. “My objectives are…”
  - Hypothesis or hypotheses
    - Propose specific, testable hypotheses.
    - Overly broad hypotheses (e.g. “I propose that some genes will be up-regulated under water stress”) are useless and should be avoided.
    - State your hypotheses clearly and unambiguously, e.g. “My hypotheses are…”
  - Significance, uniqueness
    - Discuss where your proposed research goals fit with the field.
    - How will your study advance the field and our understanding of an important biological process?
    - Avoid overly broad and ambitious statements (e.g. “This work will save starving people”).
3. Progress to date (follow a format similar to research publications)
  - Text describing preliminary results, including methods used, discuss appropriate controls
  - Present figures and/or tables of your data
  - Figures and tables need to be prepared to a publication quality standard even if they don’t have all of the components required for publication yet.
  - Figures & Tables should be numbered in the order they appear in the text and given titles. Make sure to make reference to each figure and table in the text.
  - Figure legends should clearly explain how to interpret the figure and summarize the main findings. Avoid excessive descriptions of the results in the legend. These belong in the body of the text.
  - Tables do not get legends, but explanatory information can be presented as numbered notes below the table.
4. Proposed Research / Specific Aims
  - Propose research to address your basic biological questions (i.e. to address your hypothesis, specific objectives).
  - Suggested format for this section:
    - Specific Aim 1
      - Rationale
        - Very briefly explain what question are you addressing and your expectations. Refer back to you hypotheses.
      - Methodology
        - How will you carry out the experiment?
        - This is one of the most difficult parts of the proposal because you have to provide enough detail to convince reviewers that you know what you are doing without overloading them with minutia (don’t forget controls).
      - Potential Pitfalls & Alternative Approaches
        - Use this subsection to make it clear you know what potential complications may arise and how you will deal with these. You should also briefly describe alternate approaches in case your original plan doesn’t progress as expected.
    - Specific Aim 2 …
  - Remember, this is your research plan for the remainder of your PhD. Does it make sense? Can you finish it in an appropriate amount of time? Will the research make important new contributions to your field?

5. Discussion
    - Integrate all of the previous sections.
    - Discuss how your aims derive from your progress to date.
    - Discuss the significance of your current data and expected contributions of your proposed PhD research.
    - Explain how your research contributes / impacts / advances knowledge to the basic biological processes in your research field? In other words, place your project in the context of your field of research.
6. Timetable
    - Gantt chart preferred
    - Make realistic expectations for completion of each aim.
7. References
    - You are free to use any format for in-text citations.
    - References must list all authors and full titles.

ORAL PRESENTATION

- 20-25 minutes in length + 5 minutes for questions (CSB Grad office will set the times)
- Explain your research to an educated but non-specialized audience.
- Everyone in CSB should be able to understand what you are doing and why it is significant.
- Suggested structure (should mirror your written proposal)
    - Introduction to the research topic, background, significance, uniqueness
    - Overall goal and objectives
    - Hypothesis or hypotheses
    - Progress to date
    - Specific Aims
    - Discussion of results/progress to date and expected contributions of your proposed research
    - Concise timetable (Gantt chart preferred) for completion of work related to each objective

Goals of Oral Presentation, Written Report, and Exam:

- To establish that you have a firm grasp of the underlying principles and concepts associated with the study.
- To ensure that the proposed research, methods and techniques are appropriate, and that there is every expectation of completing the study as indicated.
- To make suggestions for the improvement of your research program.

What will you be examined on?

- The steps in the proposed program, including, where appropriate, details of the aims and the feasibility of their successful execution
- Background knowledge directly related to the proposed research program, this may include general questions about your field of research
- The development of research skills directly related to the proposed research program
- Anticipated completion dates for the steps in the proposed program
- Keep in mind:
    - Your proposed research must address key outstanding biological questions, and not simply be a list of techniques.
    - Your proposed research must <u>make sense</u> to an educated but non-specialized examiner.

- There must be a reasonable expectation that the research can be completed in the proposed time.
- Know the limitations of your approaches that you are proposing and how to address them
- You should have a backup plan if one or more of your research aims doesn't work as expected.

Note that your proposal should allow the examining committee to envision the Chapters of your PhD thesis (even if they are likely to change) and reassure them that it will be successful.

The outcome for a PhD **proposal** exam will be:

- Pass and proceed in PhD program
- Fail: the student has shown a considerable lack of background knowledge and poor development of research skills and will be asked to leave the program
- Incomplete: the student has demonstrated some of the required skills and knowledge but has not satisfied the committee. The student will be asked to repeat the proposal process within 3 months at which time the student will either pass or fail. The re-examination may or may not include the public seminar component, at the discretion of the examining committee.

The PhD Thesis

When writing the thesis, consult the "Producing Your Thesis" section of the SGS website at: *https://www.sgs.utoronto.ca/current-students/program-completion/producing-your-thesis/*

Historically, the PhD thesis has taken one of two distinct forms. The first is a traditional format that includes separate sections for the Introduction, Materials and Methods, Results and Discussion. The second is a series of published, submitted or in-preparation articles from the primary literature. Either format can be used, provided that the following requirements are met:

- A general abstract for the entire thesis should be provided at the beginning of the thesis.
- A list of abbreviations and a detailed table of contents are required. This facilitates the job of the reviewer and allows readers to quickly find data/definitions.
- A general introduction to the thesis must be provided. This should include the overall hypotheses/objectives of the study and the *raison d'être* for undertaking the investigation.
- Detailed materials and methods must be provided. The purpose of this section is to permit a reader to repeat your experiments. If citing methods of others, insure that the method is correct and state any modifications of it. If your thesis is a series of papers, it may be appropriate to present detailed methods in an Appendix.
- The results section often is divided into sub-sections, each describing a facet of the research. It is appropriate to preface data by presenting a hypothesis and the approach taken to test it.
- A general discussion is given at the end of the thesis. This should be a synthesis of the research undertaken and how it impacts that of others. Model building (if appropriate) and the general significance of the research are presented here. If the format is a series of papers, the general discussion is an absolute necessity, especially when the individual chapters address different aspects of the general topic.
- Appropriate references to the literature must be included. If the format is a series of papers, reference lists may be included in the individual chapters. Alternatively,

individual chapter lists should be omitted and a complete reference list placed at the end of the thesis.

- Joint (co-authored) papers may be included as part of your thesis if intellectual property issues are worked out in advance and approval is sought from the graduate unit. In all cases of joint publication, there should be a statement in the thesis explaining the nature of the collaboration and the contribution of the thesis author. Note however, the University of Toronto does not permit joint (co-authored) theses.
- Tables and figures (plates may be an exception) should be dispersed throughout the text as appropriate, not grouped at the end of a chapter as for a submitted manuscript.
- A thesis should be viewed as a coherent complete work. It should not frustrate reviewers by having too many things repeated in each chapter (a common complaint) or by the need to search for figures and tables or references that are not rationally placed.

The completed thesis must be submitted to the Thesis Approval (i.e. supervisory) Committee at least two Fridays before the scheduled date of the Thesis Approval Meeting. ***The thesis must be in all respects a final copy, not a draft***. Supervisors are asked to sign the "Approval of Thesis" form, indicating that the thesis is free, or near free, of typographic, orthographic and punctuation errors, and that elementary rules of English have been followed throughout the thesis. The "Approval of Thesis" form should be delivered to the Graduate Office and copied to all Thesis Approval Committee members along with the thesis. Failure of a supervisor to sign the approval form may result in the cancellation of the Thesis Approval Meeting by the Associate Chair of Graduate Studies. The Associate Chair of Graduate Studies may also cancel the evaluation if the student fails to deliver the thesis to Thesis Approval Committee members two weekends before the evaluation, leading to an inevitable delay in the scheduling of the School of Graduate Studies PhD Final Oral Examination.

Thesis Approval Meeting

The Cell & Systems Biology PhD program requires that all PhD candidates present their thesis for evaluation to a Thesis Approval Committee before proceeding to the School of Graduate Studies (SGS) PhD Final Oral Examination. The Thesis Approval Meeting must be held six to eight weeks prior to the SGS PhD Final Oral Examination. Consult the Graduate Office for deadline dates for convocation and the CSB website (*http://csb.utoronto.ca/graduate-studies/current-students/forms/*) for "PhD Thesis Approval Meeting Guidelines". Members of the Thesis Approval Committee who evaluate the thesis are expected to advise the student and supervisor as to whether or not changes are necessary before the Final Oral Examination (FOE) is formally requested and the thesis is distributed to the FOE committee members. The student and supervisor must evaluate the recommendations and act accordingly.

Nature of the Thesis Approval Meeting

The Thesis Approval Meeting will be based on: (1) an assessment of the thesis containing the results of an original research study, (2) the ability of the candidate to defend the thesis and (3) the ability of the candidate to show a mastery of the research topic. The candidate must demonstrate that he/she understands the topic, can defend the thesis, and can place the findings in a general context. The candidate may also be asked to comment on the research developments in his major field of study. While not a formal exam, it should be conducted in a way that will prepare the student for the School of Graduate Studies Final Oral Examination.

Thesis Approval Committee

The committee for the Thesis Approval Meeting, consisting of the Supervisor and other

members of the Supervisory Committee, will meet with the candidate *in camera* at a meeting time organized by the candidate.

Responsibilities of the Thesis Approval Committee

Each of the Thesis Approval Committee members should evaluate the thesis. The scientific qualities of the work presented should be those associated with published studies in refereed journals. The standards of quality that are imposed should be equivalent to those of a peer review. The Thesis Approval Committee must be satisfied that the study was performed with care and that, when necessary, appropriate controls were used. The interpretations of the results should be consistent with the data presented. The candidate is expected to place the results of his/her study into context in terms of the particular research topic. This should include a literature review and an assessment of the results in relation to the findings from relevant studies.

Conduct of the Thesis Approval Meeting

The candidate must organize the Thesis Approval Meeting at a time of mutual convenience for all members of the Thesis Approval Committee, and book an examination room for this purpose. The candidate is responsible for ensuring that their audiovisual needs will be met at the presentation. Up to three observers may attend the closed discussion portion of the evaluation, subject to the approval of the supervisor and the candidate. The observers can be anyone who would like to attend the evaluation, and could include friends and members of the candidate's family. The observers must be solely observers, and not disrupt the evaluation in any way. The observers must leave at the conclusion of the evaluation before the assessment of the performance of the candidate.

At the beginning of the Thesis Approval Meeting, the student (and any observers) will be asked to step out of the room so that the Thesis Approval Committee can discuss the nature of the meeting. The student is then invited back into the examination room to make a presentation in the form of thesis summary seminar of approximately 20 minutes.

Feedback on the thesis and presentation is given by the Thesis Approval Committee. Editorial comments can be discussed at the Thesis Approval Meeting, but it is recommended that the student be provided with a list of such comments by each Thesis Approval Committee member to aid in revision of the thesis. At the end of the question period, the candidate is asked to step outside of the room. After the candidate has withdrawn from the room, the Thesis Approval Committee will engage in a discussion on the quality of the thesis and the performance of the candidate. The Thesis Approval Committee then compiles recommendations to improve the quality of the thesis and help prepare the candidate for the SGS Final Oral Examination. The candidate will be informed of the outcome of the assessment by the Thesis Approval Committee: pass with the recommendation to proceed to the SGS PhD Final Oral Examination, or fail with the recommendation to complete more research and/or significant revisions. The Department will not allow theses that have not been approved by their Thesis Approval Committee to be submitted for the SGS Final Oral Examination.

Pre-Final Oral Examination Public Presentation of the Thesis

After the thesis is approved at the departmental Thesis Approval Meeting, the candidate arranges a 40-45 minute public seminar to present the thesis to a general audience. This seminar will often occur immediately before the School of Graduate Studies Final Oral Examination.

School of Graduate Studies PhD Final Oral Examination

After the thesis is approved at the departmental Thesis Approval Committee, the SGS Final Oral Examination is arranged. Consult the CSB website (*http://csb.utoronto.ca/graduate-studies/current-students/forms/*) for the "PhD Examination Guidelines". The CSB Graduate Office will then send the "Certificate of Completion", the thesis abstract, and the examining committee "Nomination Form" to the PhD Office at the School of Graduate Studies.

Composition of the Final Oral Examination committee

The Final Oral Examination Committee (FOEC) is composed of: the supervisor, the external examiner, two faculty members from the Graduate Program in Cell & Systems Biology who were members of the student's Supervisory Committee, and one or two SGS faculty member(s) from the Graduate Program in Cell & Systems Biology or another department at UofT who were ***not*** members of the Supervisory Committee. The School of Graduate Studies provides a Chair for the exam, and SGS requires a quorum of five Final Oral Examination committee members, excluding the Chair. **A minimum of two actively participating examiners must come from outside of the supervisory committee**. Recommendations for the membership of the committee are made by the Department and approved by the Vice Dean of the School of Graduate Studies.

The PhD candidate and the supervisor should provide the CSB Graduate Studies Committee with a ranked list of potential external examiners for approval. To fulfill SGS requirements, the external examiner must be a member of the graduate faculty at another university, and **must be an Associate or Full Professor** (or equivalent) at the home institution. The potential external examiner will be of high academic standing with an established record in research, and demonstrated leadership in the particular research field, which should include successful supervision of graduate students themselves. This does not preclude scientists from industry or government agencies of equivalent professional standing, but special permission must be obtained by the Vice Dean of Graduate Studies in these cases. It is the supervisor's responsibility to ask the examiner to serve on the committee once the examiner has been approved by SGS. The supervisor and student should recommend a possible date at either 10 am or 2 pm after consultation with all committee members (other start times are possible). The final oral examination can be held at the School of Graduate Studies or at the department.

External Examiners will be paid an honorarium of $250 Canadian for the written appraisal. The written appraisal must be received by the Graduate Office at least two weeks before the examination date. If the appraisal has not been received one week prior to the exam, the department could potentially be asked to reschedule the final oral examination. The student and all committee members receive a copy of the external appraisal at this time. The candidate must not discuss the content of the appraisals with the external examiner before the examination. The department will reimburse the external examiner $500 for travel and accommodation. The balance of the expenses must be paid by the supervisor's research grant.

The PhD Thesis

It is the responsibility of the student to ensure that the examiners receive a copy of the thesis no later than six weeks, and preferably longer, before the date of the Final Oral Examination. It is the supervisor's responsibility to ensure that the changes to the thesis recommended at the departmental evaluation are complete.

Conduct of the PhD Final Oral Examination

The candidate is first asked to leave the examination room briefly while the fulfillment of degree requirements are ascertained and the exam procedure is finalized. The Chair of the FOE will then invite the candidate back into the room and the candidate is asked to orally summarize the research and conclusions of the thesis in no more than twenty minutes (unless the examination immediately follows a PhD exit seminar, in which case the student will not be asked to provide a summary of the thesis). The Chair will then invite each member of the FOE committee, in turns of approximately equal duration, to ask questions of the candidate. Typically, the external examiner will begin the question period. Generally there are two rounds of questions, with each examiner provided up to 15 minutes to ask questions in each round. At the end of questioning, the candidate will be asked to leave the room while the vote is taken. The FOE Chair then informs the candidate of the decision (minor corrections, minor modification, or adjournment). The Chair of the Examination Committee is responsible for seeing that the Candidate's file is returned to the Doctoral Examinations Office if the exam is held at the School of Graduate Studies (SGS). If the exam is held outside SGS, the exam file with all original materials will be given to the administrative staff of the candidate's graduate unit. The administrative staff will convey the result and necessary documents to the Doctoral Exams Office and the candidate's graduate unit will convey the post-exam instructions to the candidate. The graduate unit will have received the appropriate documents and information from SGS shortly after the defense.

Final submission of the completed PhD thesis

Once revisions to the thesis have been completed to the satisfaction of the supervisor, and following confirmation with the CSB Graduate Office, the student must submit an electronic copy to the ProQuest Digital Library. The supervisor should send an email to the PhD Office at SGS (sgs.doctoral@utoronto.ca), verifying that the final, revised thesis is ready for electronic submission.

Instructions on how to prepare, format, convert to PDF, and submit an electronic thesis (ETD) to the ProQuest Digital Thesis Repository are available on the following SGS Web page:
https://www.sgs.utoronto.ca/current-students/program-completion/producing-your-thesis/

GRADUATE COURSES

The Modular Nature of CSB Graduate Courses

Graduate course offerings in the Department of Cell & Systems Biology are module based. Some modules emphasize new techniques, technologies or approaches, and how these are applied to research problems. Others focus on fundamentally important concepts in cell, molecular and systems biology. Modules serve three main objectives: 1) to develop an awareness of current progress in research, including important mechanistic insights into biological organisms, as well as cutting-edge techniques, approaches and technologies in cell, molecular and systems biology, 2) to develop abilities in interpreting and criticizing scientific approaches and data, 3) to improve writing and/or verbal skills.

Most modules in the Department of Cell and Systems Biology are one-half of a one-term course. Thus, one module is one quarter course equivalent (i.e., **0.25 FCE**).

The majority of the modules offered in CSB are **seminar-based modules** that are **6 weeks in**

duration, with 2 hours devoted to the module per week. The weekly meetings are generally comprised of a combination of student seminars and discussion of the seminar topics. In contrast to the seminar-based module, some modules may be offered as **workshop-style modules** over a **compressed timescale**. Workshop-based modules are primarily focused on practical aspects of cell, molecular and/or systems biology. The structure of workshop-based modules is dictated by the best pedagogical practice for learning theoretical aspects of the course material, and the execution of the practical aspects of the course. Regardless of its structure (i.e., 6 week seminar *versus* workshop), most modules will be offered at least every other year (i.e., once every two years).

Module expectations

Regardless of its structure (i.e., 6 week seminar *versus* workshop), any given module will normally have the following components:

1) ***Course syllabus:*** The course syllabus is made available to students in advance of each academic year in which the course is offered. The syllabus indicates the term in which the module will be offered, and contains a brief description of the course as well as a list of likely seminar topics. Pre-requisites (if any) are listed. A preliminary list of course literature (generally advanced textbooks) may also be provided. The syllabus also includes a breakdown of the grading scheme for the course, which generally will be split between a combination of seminar presentation(s), course participation, and written work.

2) ***Grading scheme:*** Each module will have a grading scheme that will be based on presentations, written work and participation, with grades allocated to these categories according to the relative amount of work assigned to each category. For example, the grading scheme may be 40% for a seminar presentation, 40% for a written essay, and 20% for participation. The grading scheme will be provided at the first meeting of the course.

3) ***Organizational meeting:*** This meeting will be held prior to the beginning of the first officially scheduled meeting. The purpose of the organizational meeting is to outline the nature of the course, including the grading scheme and assignment of course elements, such as seminar, to distribute course materials if necessary, and, importantly, to determine the course schedule. The date, time and place of the first organizational meeting will be announced to faculty and students prior to each academic session. For seminar-based modules, the organizational meeting will also be used to set the day and time of the weekly seminars for the next 6 weeks. For seminar-based modules, the day and time of the weekly meetings is selected based on student and faculty schedules. Less latitude in the timing of meetings is likely for workshop / practical-based modules. For both seminar-based and workshop-based modules, the module instructor (i.e., the faculty member in charge of the module) will also initiate a discussion of possible topics at this first organizational meeting.

4) ***Topic choice:*** At the second meeting of seminar-based modules, students select topics from the list drawn up at the first meeting. There may also be an element of topic presentation in workshop-based modules, and the second meeting would fulfill an equivalent role in these modules as well. If two students wish to discuss the same topic it should be possible for each of them to discuss different aspects. A timetable is drawn up of the dates when each topic will be given. Normally, the module instructor will provide the initial presentation.

5) ***Presentations:*** Students are expected to present at least one seminar during a seminar-based module. Students will also be required to present the outcome of their work in a workshop-based module. The length of the presentation and the criteria by which is will be

evaluated will be clearly indicated at the beginning of the module by the module coordinator.

5) ***Course participation:*** Students are expected to be present at all sessions of the module, and to provide input into discussions, which will be evaluated by the module coordinator.

6) ***Written work:*** Students are expected to produce at least one major piece of written work for a module, according to the terms and evaluation criteria set out by the module coordinator.

7) ***Student evaluation***: Student work, including seminar(s), participation and written work, will be evaluated by the module coordinator according to criteria laid out by the module coordinator. Feedback of student performance will be provided by the module coordinator throughout the duration of the module, ensuring that the required amount of graded material is returned to the students before the drop date set by the course instructor. Grades will be provided in a timely fashion, with an overall course grade assigned before the end of the academic term in which the module has been offered.

8) ***Course Evaluation:*** Toward the end of the module, students will be sent an email requesting that they complete an online course evaluation.

A recommended structure for a Seminar-based Module can be found in Appendix 1.

CSB MSc students are required to take 0.5 FCE, while PhD students are required to take 1.0 FCE during their entire degree program.

One course code (CSB 1020H) is used for all CSB modules. Each module will have a unique title and a specific section code, which students can request using ACORN. Each module will also have 'F' or 'S' following CSB 1020H, based on the session in which the module is completed (i.e. any module that is completed before December 31 will have a course code of CSB 1020H/F, while any module that ends by April 30 will use the code CSB 1020H/S. For summer offerings, the appropriate code will be clearly stated on the course list as it appears on the CSB website).
*In rare cases where a student chooses two modules that are held in the same session, the student will need to contact the CSB Graduate Office to make arrangements, because ACORN will not allow the same course code (CSB1020H) twice in one session. The CSB Graduate Office can arrange to set up the same course under the code CSB1021H.

In practical terms, to meet their program requirements, most MSc students will only need to register for two CSB 1020H modules, and PhD students will only need to register for four CSB 1020H modules, or any combination of quarter and half credit courses totaling 1.0 FCE.

Module Drop Dates

Because modules do not necessarily start at the beginning of a normal academic term, the SGS drop dates will not apply for many CSB graduate modules. Drop dates for a given module will be established by the instructor at the beginning of the module, but will be within the halfway point of the duration of the module.

Seminar and lab-based modules offered 2024-2025

Course: Foundational Discoveries in Genome Biology and Bioinformatics
Course Code: CSB 1482H/F, Teaching Section LEC 0101
Coordinator: *Professor Alan Moses*
Offered: Fall 2024 session
Weight: Half credit (0.5 FCE)
Time: Tuesdays 11 am – 1 pm
Location: St. George campus, University College, room 67
Enrolment: Limited to 6 graduate students (minimum 3 reserved for CSB grads)

*CSB 1482H/F is a half-credit course that takes place during the full Fall session. It is the equivalent of two modules. This course is also offered to undergraduate students as CSB 471H1S. Graduate students should NOT request this course as CSB471H1S on ACORN because it would not count toward graduate credit.

Description:
This course will focus on close reading and detailed discussion of landmark papers in genome biology and bioinformatics. Focus will be on the context of the paper, technological developments exploited (or reported) and impact on the field. Topics include: comparative, population and functional genomics, single cell genomic technologies, genome browsers, alignment and clustering algorithms. Evaluation will be focused on class discussion and presentations.

Evaluation:
Class participation (30%)
In-class presentation (35%)
Written report (35%)

Pre-requisites: Instructor approval

Module: Self/Non-self-Recognition in Plants
CSB 1020H/F, Teaching Section LEC 0106
Coordinators: *Professors Daphne Goring and Keiko Yoshioka*
Offered: Fall 2024 session for six weeks on Sept. 11th and 25th, Oct. 2nd, 16th, 23rd, and 30th.
Weight: One module (0.25 FCE)
Time: Wednesdays 1 pm - 3 pm
Location: St. George campus, Earth Sciences Centre, Room TBA
Enrolment: Limited to 9 students

Seminar topics:
Week 1: Introductory lecture and reading assignments.
Weeks 2-6: Students presentations and discussion (2 presentations/week, 1 on week 6)
Week 6: Summary Discussion

Description:
The molecular and cellular basis of self/non-self-recognition is an active area of research for a number of key biological processes in plants. This module focuses on two broad areas: self/non-self-recognition in pollen-pistil interactions (compatible pollen acceptance, incompatible pollen rejection) and plant-microbe interactions (immunity, beneficial interactions). In this seminar course, students will investigate the current knowledge of self/non-self-recognition of plants. The course will provide a forum for an interactive discussion between the instructors and

students and will be based on a selection of current high impact primary research papers.

Evaluation:
Each student will present a PowerPoint style presentation based on an assigned topic using a selection of primary research papers. A written summary on one key research article will also be due at the end of the module. The written summary on the primary research article will follow a format similar to a *Science Perspective/Nature News & Views/Cell Preview* which not only explains and provides context of the research to a broader audience, but also poses questions and future directions for this research. Students are expected to read all papers and participate in all discussions. However for each presentation, two students will be assigned the task of asking questions and leading the discussion.

Grading: 50% Presentation (one presentation per student on a primary research paper)
25% Leading discussions/Participating in discussions
25% Written Summary

Pre-requisites for module: undergraduate courses in molecular and cell biology
Reading materials: TBA
Website: Quercus

Module: Introduction to R
CSB1020H/F, Teaching Section LEC 0142
Offered by the *Centre for the Analysis of Genome Evolution & Function (CAGEF),*
Fall 2024 session
Instructors:
Dr. David S. Guttman, CSB, CAGEF david.guttman@utoronto.ca
Dr. Calvin Mok, CAGEF Bioinformatics calvin.mok@mail.utoronto.ca
Time**:**
September 4 – October 16 (7 weeks)
Wed, 1:00 - 4:00pm
Earth Sciences Centre 3087
Enrollment:
20 graduate students
Audit spaces based on availability
Weight: One module (0.25 FCE)

Course Objectives
This is a beginner's introduction to R and the Jupyter Notebook environment for individuals with no prior experience or background. Individuals who complete the course will be able to:

- Work with the RStudio and Markdown Notebook environment and navigate the R programming language.
- Understand data structures and data types.
- Import data into R and manipulate data frames.
- Transform 'messy' datasets into 'tidy' datasets.
- Make exploratory plots as well as publication-quality graphics.
- Use string searching and manipulation to clean data.
- Perform basic statistical tests and run a regression model.
- Use flow control and build branching code.

Throughout the course we'll work with a set of data that takes us through the various steps of analysis from importing to data wrangling to statistical analysis and visualization. Each class will consist of a short introductory section followed by 'code-along' hands-on learning that will gradually build up the lecture's topic(s). Students are expected to have access to a computer during class and are encouraged to ask questions while coding along with the instructor. A homework assessment will be assigned after each class to reinforce the skills learned and a final project will test overall knowledge and application. The course materials will be provided through Quercus and lectures will be held in-person using the University of Toronto JupyterHub and its RStudio server.

Course Availability

This course will be held in-person (unless otherwise determined) and will be available to graduate students in CSB and EEB. Auditor spaces will be based upon available space to postdocs, staff, and faculty, although only registered students will be evaluated. The course will count as a single module (0.25 credits) for CSB and EEB graduate students. All graduate students interested in taking the course for credit should enroll through ACORN.
Anyone wishing to audit the course should fill out the request form at:
https://forms.gle/JAJFK76vKcWA6kKD7

Evaluation

Item	Note	% Mark
Completed R Markdown Notebook	7 lectures x 2% each*	14%
Homework Assignments	6 weekly assignments x 6% each	36%
Term project	Due 2 weeks after the end of the course	50%

* a 3.5% bonus (0.5% per lecture) will be awarded for submitting notebooks within 24 hours of lecture completion.

Pre-requisites**:** Access to a computer. No prior programming experience required.

Reference Material: *R for Data Science* (http://r4ds.had.co.nz/)

Syllabus

Class	Topic
1	**Introduction to R, RStudio and R Markdown Notebooks**: R and R Markdown basics, best coding practices, functions and syntax, data types and structures, mathematical operations with R objects, installing R packages, getting help.
2	**How to read, write, and manipulate your data:** Importing text and Excel files, the dplyr package and functions to manipulate tabular data.
3	**Introduction to Tidy Data**: Wide versus long data formats, reshaping data with the tidyverse package.
4	**Data visualization with ggplot2**: The grammar of graphics; scatter, line, box, bar, and density plots, among other types of graphics.
5	**Data cleaning with regular expressions (RegEx):** Introduction to RegEx; inspecting, cleansing, and data wrangling using RegEx; classes, quantifiers, operators, pattern-matching, and string manipulation.

6	**Linear regressions**: Simple and multiple linear regressions, ANOVA, ANCOVA, model selection.
7	**Flow control**: for loops, conditional statements (if, while, repeat, next, and break); troubleshooting loops.

*Subject to change

Module: Plant Bioinformatics
CSB1021H/F, Teaching Section LEC 0139
Coordinator: *Professor Nicholas Provart*
Offered: Fall 2024, from mid-October to late November
Weight: One module (0.25 FCE)
Time: TBA
Location: Earth Sciences Centre. St. George campus (room TBA)
Enrollment: Limit of 8 students

The past 15 years have been exciting ones in plant biology. Hundreds of plant genomes have been sequenced, RNA-seq has enabled transcriptome-wide expression profiling, and a proliferation of "-seq"-based methods has permitted protein-protein and protein-DNA interactions to be determined cheaply and in a high-throughput manner. These data sets in turn allow us to generate hypotheses at the click of a mouse. For instance, knowing where and when a gene is expressed can help us narrow down the phenotypic search space when we don't see a phenotype in a gene mutant under "normal" growth conditions. Coexpression analyses and association networks can provide high-quality candidate genes involved in a biological process of interest. Using Gene Ontology enrichment analysis and pathway visualization tools can help us make sense of our own 'omics experiments and answer the question "what processes/pathways are being perturbed in our mutant of interest?"

Structure: each of the 6 classes will draw on material from Prof. Provart's two Plant Bioinformatics courses running on Coursera.org - Plant Bioinformatics and the Plant Bioinformatics Capstone. Tools explored will include those listed below. We expect to cover around 2 “modules” (in the Courserian sense) per class, with the classes towards the end taken up with capstone presentations.

Module 1: GENOMIC DBs / PRECOMPUTED GENE TREES / PROTEIN TOOLS. Araport, TAIR, Gramene, EnsemblPlants Compara, PLAZA; SUBA4 and Cell eFP Browser, 1001 Genomes Browser
Module 2: EXPRESSION TOOLS. eFP Browser / eFP-Seq Browser, Araport, Genevestigator, TravaDB, NCBI Genome Data Viewer for exploring RNA-seq data for many plant species other than Arabidopsis, MPSS database for small RNAs
Module 3: COEXPRESSION TOOLS. ATTED II, Expression Angler, AraNet, AtCAST2
Module 4: PROMOTER ANALYSIS. Cistome, Athena, ePlant
Module 5: GO ENRICHMENT ANALYSIS AND PATHWAY VIZUALIZATION. AgriGO, AmiGO, Classification SuperViewer, TAIR, g:profiler, AraCyc, MapMan (optional: Plant Reactome)
Module 6: NETWORK EXPLORATION. Arabidopsis Interactions Viewer 2, ePlant, TF2Network, Virtual Plant, GeneMANIA

Grading will be based on participation (20%), a tools presentation (20%), a written report (capstone paper; 35%), and a final presentation (25%).

Module: Regenerative Medicine
CSB1020H/F, Teaching Section LEC 0154
Coordinator: *Professor Penney Gilbert (penney.gilbert@utoronto.ca)*
Offered: Fall 2024, from late October to late November (Fridays from October 25th to November 29th)
Weight: One module (0.25 FCE)
Time: 10 am – 12 pm
Location: Ramsay Wright Building, St. George campus (room TBA)
Enrollment: Limit of 14 students
Description:
In this course we will delve into the innovative world of regenerative medicine; a translation-forward research field that aims to restore function to aged, injured, and diseased tissues. Our journey will begin by highlighting foundational discoveries in stem cell biology that opened up new regenerative medicine possibilities, followed by tracking the path forged by subsequent researchers to overcome hurdles impeding the translation of the initial discovery to clinical practice. Curated journal articles and videos, and break-out activities will frame our discussions of stem cell biology, biomaterials, tissue engineering, and gene therapy approaches to restore function to blood, heart, and skeletal muscle tissues, while we also consider the ethics and the translational hurdles associated with regenerative medicine therapies. Canada is the proud birthplace of the discovery of stem cells, and much of the research we will draw upon was developed by scientists in Canada.

Course Format:
This is a participatory course, meaning that we will learn through our interactions with one another in class. Each week on Quercus there will be required pre-class readings and other materials to review to prepare the student for the upcoming class. The class component of the course, comprised of class discussions, break-out activities, and short knowledge check quizzes, will be delivered synchronously and in person.

Evaluation:

Knowledge Check Quizzes	30%
Participation	30%
*Rabbit Hole Assignment	40%
Total	100%

*Regen Med "Rabbit Hole" Assignment
To encourage curiosity and independent learning, this course has a Rabbit Hole written assignment. Professor Gilbert will provide a list of possible Rabbit Hole topic areas for students in the class to choose from. The topics will be related to the course materials, but are not directly covered within the course content. Each student will choose one of the topic areas for which to conduct their independent inquiry. With few exceptions, no two students may work on the same topic area. Rabbit Hole assignments are due on the final day of class. Additional details of this assignment can be found in the Rabbit Hole Assignment module on Quercus.

Website: Quercus

Module: Pathogenic Effector Biology
CSB1021H/F, Teaching Section LEC 0156
Instructor: Professor Darrell Desveaux (darrell.desveaux@utoronto.ca)
Offered: Fall 2024 (5 weeks, starting Wednesday, October 23rd)
Schedule: 10:00 AM – 12:00 PM, Wednesdays
Weight: One module (0.25 FCE)

Location: Earth Sciences Centre, room 4000
Enrolment: Limited to 4 graduate students

Description:
Microbial pathogens inject effector proteins into host cells in order to sabotage cellular systems and favor the infection process. This course explores the molecular details of how cellular systems are manipulated by pathogenic effectors to promote the infection process, while emphasizing interesting structural and biochemical features of effector biology along the way. The course will also compare and contrast the strategies employed by plant versus animal pathogens, and how immune systems have evolved to cope with cellular hijacking by pathogenic effector molecules.

Evaluation:
Participation: 30%
Test: 40%
Assignment: 30%

Module: Fundamentals of Genomic Data Science
CSB1021H/F, Teaching Section LEC 0131
Offered by the *Centre for the Analysis of Genome Evolution & Function (CAGEF)*.
Fall 2024 session
Instructors:
Dr. David S. Guttman, CSB, CAGEF david.guttman@utoronto.ca
Dr. Calvin Mok, CAGEF Bioinformatics calvin.mok@mail.utoronto.ca
Dates:
October 30th – December 11th (7 weeks)
Wednesdays, 1:00 - 4:00pm
Earth Sciences Centre 3087
Enrollment:
16 graduate students
Audit spaces based on availability
Weight: One module (0.25 FCE)

Course Objectives
The rise of next-generation genomics has changed the way we think about, study, and employ genetic data, enabling applications that were, until recently, merely the stuff of science fiction. These advances have dramatically increased both the size and scope of biological datasets, and consequently, increased the need for basic computational literacy for nearly all biologists.

This course is designed to serve as an introduction to genomic data science for students who do not have a background in bioinformatics. Students in the course will learn to perform several basic genomic data analyses using Galaxy, an open, web-based platform that incorporates multiple bioinformatics tools into a friendly Graphical User Interface (GUI). Students will then learn to scale up these genomic analyses using the Unix command line to tackle larger and more complex datasets. During the course, students will learn how to:

- Use Galaxy and command line tools to process and manipulate data
- Use the Integrative Genomics Viewer to visualize genomes
- Work in a Unix terminal
- Install bioinformatics software
- Connect and work on remote servers
- Understand common genomics file formats

- Perform de novo genome assembly, reference-based genome assembly, genome annotation, variant calling, and RNA-seq data analysis.

The course will take advantage of online resources for background material, while spending class time analyzing real data sets. Students are expected to have a basic understanding of genomics and molecular biology, but no prior computational knowledge is required.

Each class will consist of a short introductory section followed by 'code-along' hands-on learning that will gradually build up the lecture's topic(s). Students are expected to have access to a computer during class and are encouraged to ask questions while coding along with the instructor. A homework assessment will be assigned after each class to reinforce the skills learned. The course materials will be provided through Quercus and lectures will be held in-person.

Course Availability

This course will be held in-person (unless otherwise determined) and will be available to graduate students in CSB and EEB. Auditor spaces will be based upon available space to postdocs, staff, and faculty, although only registered students will be evaluated. The course will count as a single module (0.25 credits) for CSB and EEB graduate students. All graduate students interested in taking the course for credit should enroll through ACORN.
Anyone wishing to audit the course should fill out the request form at:
https://forms.gle/ECKFiqmoQ85YLeZo8

Evaluation

Item	Note	% Mark
Homework Assignments	7 weekly assignments x 9% each	63%
Term project	Due 2 weeks after the end of the course	37%

Pre-requisites**:** Access to a modern laptop (no more than 3 years old, if possible). No prior programming experience needed.

Syllabus:

Class	Topic
1	Introduction, Exploring Genomic File Formats
2	Galaxy Platform: Navigation, Quality Control, De Novo Assembly, Annotation
3	Galaxy Platform: Reference Alignment, Variant Detection, RNA-Seq
4	Galaxy Platform: RNA-Seq Command Line: Navigation, File management & manipulation, Accessing remote servers
5	Command Line: Downloading & installing software, $PATH, Testing software
6	Command Line: Quality Control, De Novo Assembly, Annotation, BLAST
7	Command Line: Reference Alignment, Samtools, Variant Detection, RNA-Seq

*Subject to change

Module: Neuroscience of Behavioral Control and Methodology
CSB1021H/F, Teaching Section LEC 0153
Instructor*: Professor J. Fraigne*
Offered: Fall 2024 session
Weight: One module (0.25 FCE)
Time: November and December, dates and times TBA.
Location: St. George campus, Ramsay Wright Building, Room TBA
Enrolment: Limited to 8 students
Description:
This course aims to review the latest neuroscience methods and how they can be used to reveal how the nervous system controls behaviours such as sleep, daily rhythms, breathing, motivation and movement. Part of the course is focused on describing methodology such as optogenetics, chemogenetics, magnetogenetics, large-scale population dynamics, genetically-encoded fluorescent sensors, and circuit-mapping transcriptomic. The other part of the course will focus on the function of cells, neurotransmitter systems, neural circuits, organs and the whole organism level to control behavioural states.

Evaluation:
Students will present two seminars based on primary research articles, one from each aspect of the course (i.e., Method and Behavioral control). They will write two brief research proposals related to their own work 1) using methodologies discussed in the course, and 2) focusing on an aspect of behavioral control. Students will also participate in the discussion. Seminars and discussions will focus on issues raised in a selection of primary research papers depending on students' interests.

Seminar = 40% (two seminars 20% each)
Proposal = 40% (two proposals 20% each)
Discussion/Participation = 20%

Prerequisites: None
Reading Materials: Primary research paper selected by Prof. Fraigne and based on the interests of the participating students.
Website: Quercus

Course: Computational Genomics and Bioinformatics
Course Code: CSB 1472H/S, Teaching Section LEC 0101
Coordinator: *Professor David Guttman*
Offered: Winter 2025 session
Weight: Half credit (0.5 FCE)
Time: Wednesdays 10 am – 12 pm
Location: St. George campus, Bahen Centre, room 2195
Enrolment: Limited to 7 graduate students (5 reserved for CSB grads)

*CSB1472H/S is a half-credit course that takes place during the full Winter session. It is the equivalent of two modules. Graduate students should NOT request the course using the undergraduate course code CSB472H1S, because it would not count toward graduate credit.

Description:
Recent technological advances have driven a revolution in genomics research that has had a direct impact on both fundamental research as well as direct application in nearly biological disciplines. These advances have made the generation of genomic data relatively straightforward and inexpensive; nevertheless, the data are meaningless if they cannot be

properly analyzed. Computational genomics and bioinformatics are the tools we use to extract biological information from complex genomic data.

CSB1472 will teach you the fundamentals of analyzing genomic data. This course emphasizes understanding how core bioinformatic analyses work, the strengths and weaknesses of related methods, and the important parameters embedded in these analyses. CSB1472 is not an applied methods course, nor a course to for developing new bioinformatic tools, but rather a course designed to provide you with a basic understanding of the principles underlying genome analyses. We will examine the fundamentals of sequence alignment, phylogenetic analyses, genome annotation, gene prediction, and gene expression data analysis. Theoretical, applied, and statistical issues will be addressed.

Recommended text: Jonathan Pevsner, *Bioinformatics and Functional Genomics*, 3rd edition (2015)

Course: Methods in Genomics and Proteomics
Course Code: CSB 1025H/S, Teaching Section LEC 0101
Coordinator: *Dr. Pauline Wang*
Offered: Winter 2025 session
Weight: Half credit (0.50 FCE)
Time: Tuesdays 12-4 pm
Location: St. George campus, Earth Sciences Centre, room 4076.
Enrolment: Limited to 2 CSB graduate students

Students who are interested in taking this course should contact Dr. Pauline Wang at pauline.wang@utoronto.ca. The course requires instructor approval, after it is requested on ACORN.

*CSB 1025H/S is a half-credit course that takes place during the full Winter session. It is the equivalent of two modules. This course is also offered to undergraduate students as CSB 474H1S. Graduate students should NOT request this course as CSB474H1S on ACORN, because it would not count toward graduate credit.

Description:
Genomics and proteomics have revolutionized biological research. It is now theoretically possible to fully characterize the structure, organization, regulation and interaction of all genes, proteins and small bioactive molecules in an organism. CSB 1025H/S is an intensive and rigorous laboratory course that will teach students how to produce and analyze data that are central to the fields of genomics and proteomics. The course is divided into three modules, the first of which focuses on genomics, the second on transcriptomics, and the third on proteomics. Each module begins with at least two wet labs where students generate data and end with computer labs where students analyze the data. In this way students will learn how to conduct an experiment from beginning to end. Techniques taught include DNA and RNA extraction, Next Generation sequencing library construction, Illumina DNA sequencing, expression profiling using RNASeq, 2D-gel proteome analysis, mass spectrometry and associated bioinformatics analyses such as sequence analysis and assembly, and statistical analysis of gene expression and mass spectrometry data. This is an advanced laboratory and computer-based course, and assumes a strong background in molecular genetics and some prior laboratory experience.

Required Text: No required textbook. Information will be provided through lectures presented in the first wet lab and first computer lab of each module.

Evaluation: Three quizzes (15%), three lab reports (45%), lab performance (20%). Graduate students have an additional grant proposal (20%).

Prerequisite: BIO 260H1/HMB 265H1 (Genetics), BIO 255Y1/CSB 330H1/350H1 or by permission of the instructor. Recommended Preparation: BCH 311H1/CSB 349H1/MGY 311Y1

Module: Introduction to Python
CSB1021H/S, Teaching Section LEC 0140
Offered by the *Centre for the Analysis of Genome Evolution & Function (CAGEF),*
Winter 2025 session.
Instructors:
Dr. David S. Guttman, CSB, CAGEF david.guttman@utoronto.ca
Dr. Calvin Mok, CAGEF Bioinformatics calvin.mok@mail.utoronto.ca
Dates:
January 9 – Feb 20 (7 weeks)
Thursdays, 1:00pm-4:00pm
Earth Sciences Centre 3087
Enrollment:
20 graduate students
Audit spaces based on availability
Weight: One module (0.25 FCE)

Course Objectives
This is a beginner's introduction to Python for data science applications. The course is intended for students with no computer science background who want to develop the skills needed to analyze their own data. Students who complete this course will be able to:

- Perform data analysis in Python using the Jupyter Notebook environment.
- Understand Python data structures and data types.
- Manipulate Python objects such as lists, data frames, and dictionaries.
- Import data into Python and transform 'messy' datasets into 'tidy' datasets.
- Use flow control to develop branching code.
- Use regular expression and string manipulation to explore and clean data.
- Make exploratory plots.

Throughout the course we'll work with a set of data that takes us through the various steps of analysis from importing to data wrangling to visualization. Each class will consist of a short introductory section followed by 'code-along' hands-on learning that will gradually build up the lecture's topic(s). Students are expected to have access to a computer during class and are encouraged to ask questions while coding along with the instructor. A homework assessment will be assigned after each class to reinforce the skills learned and a final project will test overall knowledge and application. The course will be provided through Quercus and lectures will be held in-person.
Course Availability
This course will be held in-person (unless otherwise determined) and will be available to graduate students in CSB and EEB. Auditor spaces will be based upon available space to postdocs, staff, and faculty, although only registered students will be evaluated. The course will count as a single module (0.25 credits) for CSB and EEB graduate students. All graduate students interested in taking the course for credit should enroll through ACORN.
Anyone wishing to audit the course should fill out the request form at:
https://forms.gle/KYevNYXWWBDhHdco7

Evaluation

Item	Note	% Mark
Completed Jupyter Notebook	7 lectures x 2% each*	14%
Homework Assignments	7 weekly assignments x ~5% each	36%
Term project	Due 2 weeks after the end of the course	50%

* a 3.5% bonus (0.5% per lecture) will be awarded for submitting notebooks within 24 hours of lecture completion.

Pre-requisites**:** Access to a computer and internet. No prior programming experience needed.

Reference Material**:** 2016. Severance, Charles. Python for Everybody: Exploring Data Using Python 3. http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf

Course Tools**:** University of Toronto Jupyter Hub, DataCamp, Zoom.

Syllabus

Class	Topic
1	**Intro to Python and Jupyter Notebooks:** Basics about Python, using Jupyter Notebooks, how to run Python code, as well as an introduction to Python variables, functions, modules, best coding practices, data types, missing data, code debugging and getting help.
2	**Python data structures, Numpy and Pandas:** List, Dictionaries, Tuples, Sets, Series, mathematical operations with Python objects, Introduction to NumPy and Pandas.
3	**How to Read, Write, and Manipulate Your Data:** The wide and long formats, reading in data, data wrangling with Pandas, and writing data.
4	**Data visualization with seaborn:** The grammar of graphics; scatter, line, box, bar, and density plots, among other types of graphics.
5	**Flow control:** Flow control, for loops, Conditionals
6	**Regular Expressions:** Classes, quantifiers, operators, pattern-matching, String manipulation.
7	**User-defined functions:** Defining a function, best practices in user-defined functions, and web scraping

*Subject to change

Module: Current topics in evolutionary medicine
CSB 1020H/S, Teaching Section LEC 0149
Coordinator: *Professor Maxwell Shafer*
Offered: Winter 2025 session, in January and February for a total of six meetings.
Weight: One module (0.25 FCE)
Time: TBA
Location: Room TBA
Enrolment: Limited to 10 students

Description:
Evolutionary medicine is the application of insights and knowledge from the fields of evolution and ecology to biomedical research. For example, a better understand of why humans are susceptible to certain diseases can be gained by studying our evolutionary history, and novel treatments can be found through examination of 'extreme' physiological adaptations across the tree of life. This course will cover a wide range of topics including research in non-model organisms, neuroscience and behavior, cell biology and cancer, host/pathogen interactions, and human biology, with a focus on emerging methodologies and evolutionary principles. Students will engage with each other and the instructor through presentation and discussion of current primary literature and preparation of a written component.

Evaluation:
Each session will be devoted to one of the above topics, with 1-2 students (depending on enrollment) summarizing primary literature per session. Additionally, each student will write a short Letter of Intent (LOI) proposing a research project related to their presentation topic due at the end of the module.
40% Presentation (one presentation per student)
40% Written component
20% Participation in discussions

Pre-requisites for module: None
Reading materials: Primary literature will be disseminated during an organizational meeting.
Website: TBA

Module: Theoretical and Applied Topics in Data Visualization for Genome Biology
CSB 1020H/S, Teaching Section LEC 0133
Coordinator: *Professor Nicholas Provart*
Offered: Winter 2025 session in January and February for a total of six meetings.
Weight: One module (0.25 FCE)
Time: TBA
Location: St. George campus, Earth Sciences Centre, Room TBA
Enrolment: Limited to 10 students

Description:
The past decade has seen a vast increase in the amount of data available to biologists, driven by the dramatic decrease in cost and concomitant rise in throughput of various next-generation sequencing technologies. While access to data is no longer limiting, manipulating and interpreting those data has become a bottleneck. One important aspect of interpreting data is data visualization. This graduate course module will provide a theoretical perspective on data visualization for biological applications, along with a hands-on component to provide practical training for students. The format of the course will be six 2-hour modules, each consisting of a short theory lecture of around 40 minutes followed by a discussion of 2-3 assigned papers/online resources per week, with students taking turns to present the papers/resources. The last 30-45 minutes of each module will encompass a hands-on session where students will use various data visualization packages (such as Tableau, D3, Plotly, ggplot, etc.) to explore biological data sets.

Evaluation:
20% - Contribution to discussion
20% - Presentation of assigned paper or online data resource (15-minutes)
60% - Project

The project will be to tell a story with data. You may use any technique you like (e.g., poster, interactive tool, video, etc.). It should combine data analysis, data visualization and a narrative to contextualize the findings. It should be accessible and engaging to anyone with an interest in biology.

Pre-requisites for module: Familiarity with molecular biology
Reading materials: TBA
Website: TBA

Module: Advanced Bayesian statistics for genomics
CSB 1021H/S, Teaching Section LEC 0150
Coordinator: *Professor Guillaume Filion*
Offered: Winter 2025 session, in January and February for a total of six meetings.
Weight: One module (0.25 FCE)
Time: TBA
Location: Remote or UTSC campus, room TBA
Enrolment: Limited to 10 students

Description:
This course is an in-depth introduction to Bayesian inference with the variational inference method using the programming language Pyro. It covers the basic theory of variational inference and consists of practical applications to concrete problems (vaccine efficiency, mutation rates, single-cell transcriptomics). The content consists of video lectures explaining how to use Pyro and Pytorch, and in-person lectures with laptop computers to work on practical applications. This course requires some familiarity with statistics and working knowledge of the Python programming language.

Evaluation:
The evaluation consists of a take-home exam to solve problems similar to those addressed in class.

Pre-requisites for module: No particular classes are required, but the students should be familiar with statistics and standard distributions (Poisson, binomial normal, etc.) and have working knowledge of the Python programming language.
Reading materials: None
Website: TBA

Advanced Techniques in Microscopy
CSB1021H/S, Teaching Section LEC 0147
Instructors: *Professors Ulrich Tepass, Heather McFarlane, and Sergey Plotnikov*
Offered: Winter 2025 session from late February to mid-April for eight meetings.
Weight: One module (0.25 FCE)
Time: TBA
Location: St. George campus, Ramsay Wright Building, Room TBA
Enrolment: Limited to 8 students

Description:
This course will provide an introduction to light microscopy and digital imaging in the biological sciences. The course consists of lectures, discussions, and presentations that will enable the students to obtain and interpret high quality microscope data and to understand and assess potential artifacts. The course also places a strong emphasis on appropriate sample preparation and advanced microscopy usage (e.g., confocal microscopy, total internal reflection fluorescence (TIRF) microscopy, fluorescence resonance energy transfer (FRET) imaging, and multiphoton microscopy). Particular emphasis will be placed on 'picking the right tool for the job'.

Topics to be covered include:

- Basic principles of microscope design, digital image recording, image resolution and contrast;
- Fluorescence microscopy techniques – fluorescent probes, fluorescent biosensors, TIRF, FRET, and FRAP;
- Confocal and multiphoton microscopy;

Each class will consist of two 12 min student presentations covering the fundamentals of light microscopy followed by an in-depth presentation of an imaging technique with an example of its biological application.

Evaluation:
This is a flipped classroom course, so students will learn theory through an assigned independent reading of the resource materials, review articles, and primary research papers. The in-class activities will be devoted to presentations and student-led discussions.

Item	Note	% Mark
Short (12min) presentation on imaging fundamentals	2 individual presentations x 20% each	40%
Group presentation of an imaging technique	2 group presentations x 20% each	40%
Participation in discussions	Weekly 2.5% x 8 weeks	20%

Prerequisites for module: Some background in cell/developmental biology. Prior experience in imaging is desired, but not essential.
Reading materials:

- Nechyporuk-Zloy, V. (2022). *Principles of Light Microscopy.* Springer International Publishing AG. This book is available online at the UofT library website.
- *MicroscopyU: the Source of Microscopy Education.* https://www.microscopyu.com (similar online recourses from Zeiss and Olympus can be used)
- iBiology: Microscopy Series. https://www.ibiology.org/online-biology-courses/microscopy-series/
- Review articles and research papers

Website: Quercus

Module: Animal Models of Human Conditions
CSB1021H/S, Teaching Section LEC 0155
Coordinator: *Professor Laura Corbit*
Offered: Winter 2025 session in March and April for a total of six meetings.
Weight: One module (0.25 FCE)

Time: TBA, likely Monday afternoons or Thursday mornings
Location: St. George campus, Ramsay Wright Building, Room TBA
Enrolment: Limited to 10 students

Description:
Animal models can be a powerful way to study both basic mechanisms and pathologies related to human capabilities and diseases. But the data produced are only as good as the model used to generate them. This course will cover what makes a good animal model, some of the common frameworks used for generating models, as well as limitations of this research approach. In addition to these general principles, students will have the opportunity to focus on a model of a specific process (cortical development, learned fear) or disease (e.g., Alzheimer's disease) though their work related to an in-class presentation and paper that critically evaluate the strengths and weakness of a specific model of their choice. The topic relate to their own research, but does not have to be. Attendance and participation in class discussions are an important component of the class.
*Specific Topics will be decided in an organizational meeting based on student interests

Evaluation:
Paper proposal: 10%
Presentation (of a research article): 30%
Paper (critical evaluation of an animal model): 50%
Participation: 10%

Prerequisites for module: None
Reading materials: Readings (journal articles) will be assigned throughout the course, some based on student topic selections
Website: Quercus

Module: Data Visualization and Advanced Graphics in R
CSB1020H/S, Teaching Section LEC 0141
Offered by the *Centre for the Analysis of Genome Evolution & Function (CAGEF),*
Winter 2025 session.
Instructors:
Dr. David S. Guttman, CSB, CAGEF david.guttman@utoronto.ca
Dr. Calvin Mok, CAGEF Bioinformatics calvin.mok@mail.utoronto.ca
Dates:
March 6 – April 10, 2024 (6 weeks)
Thursdays, 1:00pm-4:00pm
Earth Sciences Centre 3087
Enrollment:
16 graduate students
Audit spaces based on availability
Weight: One module (0.25 FCE)

Course Objectives
This is an intermediate to advanced level introduction to R and the packages associated with visualizing large or complex data sets. Participants are strongly encouraged to have prior experience in R (i.e., Introduction to R, CSB1020). Individuals who complete the course will be able to manipulate and prepare large datasets to produce publication-quality graphics. The goal of this course is to introduce the proper use and interpretation of simple, popular, and complex data visualizations. Topics will include

- A deep dive into building relatable figures with the ggplot package.

- Analysis and visualization of large datasets from differential expression experiments.
- Popular visualization methods and packages for genes and genome analysis.

Each class will consist of a short introductory section followed by 'code-along' hands-on learning that will gradually build up the lecture's topic(s). Students are expected to have access to a computer during class and are encouraged to ask questions while coding along with the instructor. A homework assessment will be assigned after each class to reinforce the skills learned. The course materials will be provided through Quercus and class lectures will be held in-person while using the University of Toronto JupyterHub to run an RStudio server for for lecture and assessment.

Course Availability

This course will be held in-person (unless otherwise determined) and will be available to graduate students in CSB and EEB. Auditor spaces will be based upon available space to postdocs, staff, and faculty, although only registered students will be evaluated. The course will count as a single module (0.25 credits) for CSB and EEB graduate students. All graduate students interested in taking the course for credit should enroll through ACORN.
Anyone wishing to audit the course should fill out the request form at:
https://forms.gle/zAdzVYN3SUKNdTpE8

Evaluation

Item	Note	% Mark
Homework Assignments	6 weekly assignments ranging from 15-20% each	100%

Pre-requisites**:** CSB1020 *Introduction to R* (or equivalent) with a good understanding of data wrangling using the tidyverse package. Access to a computer.

Reference Material: *R for Data Science* (http://r4ds.had.co.nz/)

Syllabus

Class	Topic
1	**Re-Introduction to R, RStudio, and Markdown Notebooks**: R and RStudio basics, setting up R Markdown Notebooks, installing R packages, best practices for producing graphs, best coding practices, functions and syntax, data types and structures, importing and exporting data, tidy data formatting, saving data and plots.
2	**The grammar of graphics with ggplot:** box-, violin-, beeswarm-, and jitter plots, combining layers in ggplot, kernel density plots, and parallel coordinate plots.
3	**Finishing touches for ggplot**: themes, aesthetics, color palettes, mathematic annotation with expression() and bquote(), scaling data, error bars, handling outliers, and multi-panel plots.
4	**Visualizing differential expression data**: heatmaps, volcano plots, side-by-side boxplots, dotplots, and Upset plots.
5	**Common visualization methods for data classification/partitioning:** clustering, principal component analysis, multidimensional scaling, and linear projection with t-SNE plots and UMAP.

6	**Simplifying Genes and genomes:** sequence logos, phylogenetic trees, network graphs, Manhattan plots, Gviz, GenomeGraphs, gene model plots and other helpful packages.

*Subject to change

Module: Current Techniques in Neuroscience
CSB1020H/F, Teaching Section LEC 0124
Coordinator: *Dr. Arbora Resulaj*
Offered: Summer (F) 2025 session, 6 classes
Weight: One module (0.25 FCE)
Location: UTM campus, room TBA
Enrolment: Limited to 10 graduate students
Schedule: Six weeks from mid-April through May, dates TBA

Description:
This course will examine emerging cutting-edge techniques that are revolutionizing fundamental neuroscience research. Techniques to be investigated include: optogenetics, chemogenetics, current strategies for cell-type-specific transgene expression and virus-based circuit tracing, large scale electrophysiology, next generation fluorescent indicators, new imaging techniques such as two photo imaging and super-resolution microscopy. Students will take an active role in researching these techniques and presenting their theoretical foundations as well as practical applications, including advantages and disadvantages, to the class.

Evaluation:

Presentation	60%
Participation	40%

Pre-requisites for module: Background in Neuroscience
Reading materials: Required readings will be primary research articles and reviews, and will be provided during the first week of class
Website: Quercus

Auditing Policy

Students may audit modules in the Cell & Systems Biology graduate program only with permission from the module instructor. Students auditing a course are expected to attend regularly, actively participate in class discussion, and give a seminar. Students who audit a module are not required to complete written work for the course, such as essays. Audited courses do not appear on the official student transcript.

COLLABORATIVE PROGRAMS

Developmental Biology

The graduate departments of Biochemistry, Cell & Systems Biology, Molecular Genetics, Laboratory Medicine & Pathobiology, Physiology, and Immunology participate in the Collaborative Graduate Program in Developmental Biology. This is a program for MSc and PhD students. Students must be registered in a MSc or PhD program in one of the host departments and must be undertaking research in developmental biology under the supervision of a member of the program. Faculty members in the Department of Cell & Systems Biology who participate in the Collaborative Graduate Program in Developmental Biology include Profs. Berleth, Bruce, Calarco, Erclik, Fernandez-Gonzalez, Gilbert, Harris, McCourt, Rhee, Saltzman, Tepass, Tropepe, and Zhen.

Students enrolled in the Collaborative Graduate Program in Developmental Biology must complete the Cell & Systems Biology MSc or PhD course and program requirements. They must complete the interdepartmental course JDB 1025H and the seminar course JDB 1026Y. For PhD students, one of these courses may be substituted for half (0.5 FCE) of the CSB course requirements upon approval by the student's Supervisory Committee and the departmental GSC.

Program requirements for the Collaborative Graduate Program in Developmental Biology can be found on the web: *http://devbio.utoronto.ca/*

Genome Biology & Bioinformatics

The graduate units of Biochemistry; Cell & Systems Biology, Chemical Engineering and Applied Chemistry, Computer Science, Ecology & Evolutionary Biology, Laboratory Medicine & Pathobiology, Molecular Genetics, Medical Biophysics, and the Institute of Medical Sciences participate in the collaborative program in Genome Biology and Bioinformatics. This is a PhD program only. Students must be registered in the doctoral program in one of the host departments and must be undertaking research in proteomics and bioinformatics under the supervision of a member of the program. Faculty members in the Departmental of Cell & Systems Biology who participate in the Collaborative Graduate Program in Genome Biology & Bioinformatics include: Profs. Calarco, Chang, Christendat, Desveaux, Edwards, Filion, Guttman, Holmes, Mitchell, Moses, Nguyen Ba, Shafer, Wang, and Provart.

All students are required to complete the interdepartmental courses or alternates:
One of JBB 2026H / CSB 1472H (formerly JBZ 1472H) / JTB 2010H / EEB 1460H (formerly JZB 1521H), and one of BME 1458H / CSC 2417H / CSC 2418H / CSC 2515H / JTB 2021H

Program requirements for the Collaborative Graduate Program in Genome Biology and Bioinformatics can be found on the web: *https://gbb.csb.utoronto.ca/*

Neuroscience

The graduate units of Cell & Systems Biology, Dentistry, Biochemistry, Computer Science, Institute of Biomaterials & Biomedical Engineering, Institute of Medical Science, Laboratory Medicine & Pathobiology, Medical Biophysics, Pharmacology, Physiology, Psychology, Rehabilitation Science, Applied Psychology & Human Development, and Pharmaceutical Sciences participate in the Collaborative Graduate Program in Neuroscience. This is a program for both MSc and PhD students.

The Program aims to enrich the training of graduate students in neuroscience. Research areas are very diverse and cover most aspects of current neuroscience research in particular, systems and cellular neurophysiology, genetic and molecular neuroscience, developmental biology, neurodegenerative diseases, neural modelling, clinical neurophysiology, and physiological psychology. Current studies include: synaptic structure and function, plasticity and learning at the synaptic and systems levels, genetic factors in neurogenesis, motor control and motor learning, central mechanisms subserving pain, signal transduction, sensorimotor processes underlying speech, regulation of neuronal calcium and its involvement in cell death, and morphological and physiological studies on the blood- brain-barrier.

Program requirements for the Collaborative Graduate Program in Neuroscience can be found on the web: *http://www.neuroscience.utoronto.ca*

Faculty members in the Department of Cell & Systems Biology who participate in the Collaborative Graduate Program in Neuroscience include: Profs. Anreiter, Arruda-Carvalho, Buck, Chang, Corbit, Gerlai, Holmes, Ito, Kim, Koyama, Lange, Lin, Liu, Martin, McGowan, Monks, Nash, Orchard, Peever, Resulaj, Rhee, Rozeske, Senatore, Shafer, Sokolowski, Stewart, Takehara-Nishiuchi, Tropepe, Woodin, Zhen, and Zovkic.

FINANCIAL SUPPORT

The Base Stipend and Sources of Income

The Department of Cell & Systems Biology provides its graduate students a base stipend. The base stipend is approximately $25,000 (MSc) or $28,500 (PhD) plus tuition in 2024-2025. For Canadian students this comes to a total of $33,400 / $36,700 and for new international students the base stipend is $37,500 (stipend plus health insurance) for PhD's. The base stipend is provided for students in the funded cohort who are progressing satisfactorily. The funded cohort in the Program in Cell & Systems Biology is defined as MSc students in years one and two, PhD students in years 1-4 if they have completed a MSc degree previously, and PhD students in year 1-5 if they entered directly from a BSc degree. Transfer students from the MSc program are provided a total of five years of funding. Funds used to make up this stipend will usually be a combination of a teaching assistantship, a U of T Fellowship, funds from the supervisor's research grant and/or an external award.

University of Toronto Fellowship (UTF)

University of Toronto Fellowship (UTF) funding is available for students in the first year of an MSc or the first four years of a PhD. In addition, MSc students in their second year will receive approximately one-third of a UTF award. ***Continuing students must have maintained a B+ average, or satisfactory progress toward their degree in the previous year***. ***Continuing students must have also completed all program requirements for the year, including supervisory committee meetings by June 30th and departmental seminar attendance. New students must have achieved a B+ average in their final year.*** The value of the UTF varies from year to year (a full UTF in 2024-2025 is worth approximately $14,000). International students are awarded a full UTF plus the cost of UHIP health insurance.

No application is required for these awards, although new students must have applied to the graduate program by the posted application deadline.

Teaching Assistantships

Where possible, a Teaching Assistant position is available to all students admitted to the program, and all students in the funded cohort will have a full TA position as part of their overall funding package, unless compensatory funds are provided by the supervisor's research grant, or other scholarship funding. A full TA position consists of approximately 140 hours (5 hrs/week) for the academic session (September to April) and conditions of employment of teaching assistants, including wage rates, are in the Collective Agreement effective January 1st, 2024. As of January 1st, 2024, the hourly rate of pay for undergraduates is $51.93 per hour. Graduate students who have not completed two years of full-time graduate study and who do not have a Master's degree (SGS I) receive $51.93 per hour. Graduate students in a doctoral program, those who have completed at least two years of full-time graduate study, and those who have a Master's degree are classified as SGS II, and they also receive $51.93 per hour. The Assistant Invigilation rate is $34.22 per hour. The policy on appointment of teaching assistants can be found in the CUPE 3902 (Unit 1) Collective Agreement. A maximum of $7,500 in TA income can be used toward the base stipend.

Applications are posted online to all graduate students (including incoming students) in June. All departmental teaching assistants are members of CUPE 3902.

Research Grant Support

In addition to a Teaching Assistantship and the above scholarships, fellowships and awards, students may receive varying amounts from a supervisor's operating grant in the form of a research assistantship. Arrangements for students to be paid from a research grant must be made between the researcher and the departmental accountants. On the St. George campus, see Baljit Brar; on the Mississauga campus, see Stephanie Melo; and on the Scarborough campus, see Ava .

Fellowships and Scholarships

External Awards

*Natural Science and Engineering Research Council of Canada (**NSERC**) Scholarships and Fellowships*

- *NSERC CGS M:* Valued at $27,000 per year for students with no more than 12 months of graduate studies. The award can only be held by an individual student for one year.
- *NSERC Doctoral Awards:* For PhD students who at the time of application have completed up to 24 or 36 (for Direct Entry and PhD transfers) months of graduate studies at the PhD level as of December 31st of the application year. Valued at $40,000/year for up to three years.
- ***All graduate students with a NSERC Doctoral Award will be awarded a $3,000 UTF top-up in each of the years that they hold the NSERC award while in the funded cohort, and students with a CGSM will receive a UTF top-up of $2,500.***
- *NSERC PDF:* Applicants for a NSERC postdoctoral fellowship should have already obtained their doctorate or will obtain it within the next year. The award is valued at $70,000 per year for two years.

*Ontario Graduate Scholarship (**OGS**) Awards*

- Valued at $15,000. Students must have achieved an A-minus average in their last two years of study.
- ***All graduate students (in the funded cohort) with an OGS will be awarded a $1,500 UTF top-up.***

*Queen Elizabeth II Graduate Scholarship in Science and Technology (**QEII-GSST**) Awards*

- Valued at $15,000 per year
- *The Joan M. Coleman QEII-GSST* is to be awarded to a student(s) in the Faculty of Arts and Science on the basis of academic excellence. Students must have maintained an overall A- average over the last two years of study at the post-secondary level. Recipients should also exhibit research ability/potential, good communication skills and interpersonal/leadership abilities. Preference will be given to a student(s) enrolled in the Program in Cell & Systems Biology studying in the field of Molecular Biology of Photosynthesis.
- *The Dr. Sherwin S. Desser QEII-GSST* is to be awarded to a student(s) in the Faculty of Arts and Science on the basis of academic excellence. Students must have maintained an overall A- average over the last two years of study at the post-secondary level. Recipients should also exhibit research ability/potential, good communication skills and interpersonal/leadership abilities. Preference will be given to a student(s) enrolled in the Departments of Cell & Systems Biology.
- ***All graduate students (in the funded cohort) with a QEII-GSST will be awarded a $1,500 UTF top-up.***

- NSERC doctoral award departmental deadlines are normally in mid-September each year. The NSERC/CIHR CGS Master's online application will close on December 1st. For OGS' and QEII-GSST's, the application deadline will be in mid-April. Please consult the CSB Graduate Office.

Note: Arts & Science policy re. external awards states that OGS, QEII-GSST and NSERC full award values are applied to the minimum stipend package for the September 1st to August 31st year, regardless of whether or not the student started payment of that award early, i.e., in May.

Vanier Canada Graduate Scholarships
The Vanier CGS program aims to attract and retain world-class doctoral students by supporting students who demonstrate both leadership skills and a high standard of scholarly achievement in graduate studies in social sciences and humanities, natural sciences and engineering, and health.

Canadian and international students are eligible to be nominated for a Vanier CGS. In an effort to support students in broadening their research horizons and seeking new challenges, the Vanier CGS program strongly encourages candidates to pursue their studies beyond the university that granted their undergraduate and graduate degrees. Students wishing to apply for a Vanier CGS must do so through the Canadian university to which they are applying for doctoral studies. The Vanier CGS Scholarships are valued at $50,000 per annum for a maximum of three years.

University of Toronto Awards – International students

Connaught International Scholarships
This scholarship is used to attract outstanding new international Ph.D. students to the graduate program. The award is valued at the base stipend for PhD's plus $10,000 per year. It is subject to renewal and is tenable for up to four years. Nominations need to be submitted by the department in early February.

Departmental Awards (amounts listed are approximate values in 2024-2025)

- *David F. Mettrick Fellowship*
  To be awarded to a qualified graduate student in the Department of Cell & Systems Biology engaging in any aspect of zoological research. Value: $600
- *Kenneth C. Fisher Fellowship*
  This award recognizes a graduate student in Cell & Systems Biology who maintains a high standard of academic and research achievement, balanced with outstanding extra-curricular contributions to their department, faculty, or the university as a whole. Value: $700
- *Elizabeth Ann Wintercorbyn Award*
  One award is made annually to a graduate student in the Department of Cell & Systems Biology engaged in research work which is likely to prove beneficial to agriculture and the second award is for a graduate student engaged in research work which is likely to prove useful to medicine. Value: $1,200 (total awarded)
- *Duncan L. Gellatly Memorial Fellowship*
  To be awarded every other year to a graduate student demonstrating excellence in virology and/or molecular biology research. Value: up to $3,000
- *Hilbert and Reta Straus Award*
  The award is made annually to a full-time graduate student who has demonstrated high research achievement in the fields of plant molecular or cellular biology. Students can only receive this award once. Value: $600
- *Sheila Freeman Graduate Award in Zoology*
  One graduate fellowship to be awarded to an incoming or in-progress CSB graduate student who is focusing his/her studies in animal biology. The award is made on the basis of financial need, academic merit will also be considered. Value: up to $3,000
- *Ramsay Wright Scholarship in Cell and Systems Biology*
  To be awarded to a graduate student in the Department of Cell and Systems Biology who is engaged in research in zoology. Value: $1,600
- *Dr. Klaus Rothfels Memorial Scholarship*
  The scholarship is awarded on the basis of academic standing and financial need to a graduate student in the Department of Cell & Systems Biology. Value: $450
- *Senior Alumni Association Prize in Cell & Systems Biology*
  To be awarded to graduate students in the Department of Cell & Systems Biology (Master's or PhD level) on the basis of financial need. Academic merit will also be considered. Value: $1,400 (approx. half OSOTF)
- *Yoshio Masui Prize in Developmental, Molecular or Cellular Biology*
  To be awarded to a master's or doctoral student in the Department of Cell & Systems Biology on the basis of academic merit. International students are encouraged to apply. Value: $3,000
- *Valerie Anderson Award*
  To be awarded on the basis of academic merit (research and course work) to an outstanding graduate student in any subdiscipline of Plant Biology. Nominations may be made by any member of the Department of Cell & Systems Biology and the recipient will be selected by the Graduate Studies Committee of the Department. Value: up to $3,000 (total awarded)
- *Vietnamese-Canadian Community Graduate Award in Zoology*
  To be awarded to a master's or doctoral student studying animal biology based on academic merit. Students must have maintained an overall A-minus average over the last two years of study. Recipients should also exhibit research ability/potential, good

communication skills and interpersonal/leadership abilities. Value: $750 (approx. half OSOTF)

- *Dr. Clara Winifred Fritz Memorial Fellowship in Plant Pathology*
  The award is made annually on the basis of academic merit to a graduate student studying plant pathology in the Department of Cell & Systems Biology. Value: up to $3,000
- *The Alfred and Florence Aiken and Dorothy Woods Memorial Graduate Scholarship in Cell and Systems Biology*
  To be awarded on the basis of academic merit to a graduate student in the Department of Cell and Systems Biology. Value: up to $2,500
- *Zoology International Scholarships*
  Awarded to foreign students that are at UofT on Student Authorizations (visa students) registered as full-time graduate students in the Department of Cell & Systems Biology who have at least a B+ average over their previous two years. Two scholarships to be awarded on the basis of academic performance and financial need. Value: $3,000 (total awarded)
- *Zoology Sesquicentennial Graduate Award*
  To be awarded to a graduate student enrolled in full-time studies in CSB, on the basis of academic merit. Financial need may also be considered. Value: $1,100
- *Rustom H. Dastur Graduate Scholarship in Cell and Systems Biology*
  Based on academic merit to graduate students studying plant sciences that successfully meet the requirements to transfer to the Ph.D. program in the Department of Cell and Systems Biology. Value: up to $2,500.
- *Dr. Christine Hone-Buske Scholarship for Outstanding Publication by a PhD student*
  The scholarship will be awarded in recognition of the publication of a peer-reviewed article in an academic journal within 18 months of the application due date. Preference for a first-author paper. Both domestic and international students are eligible. The student must be registered and in good standing. Value: $2,000.
- *Janssen Graduate Award for Equity and Inclusion at the University of Toronto*
  To be awarded to one or more graduate student(s) in health sciences/neuroscience in the Department of Cell and Systems Biology on the basis of academic merit and financial need. Preference will be given to Black and Indigenous students. Value: up to $3,500.
- *Dr. Sergiy and Tetyana Kryvoruchko Graduate Scholarship in Cell and Systems Biology*
  To be awarded to two graduate students enrolled in a Graduate Collaborative Specialization program (Genome Biology & Bioinformatics, Developmental Biology, or Neuroscience), on the basis of academic merit. Value: up to $10,000.

GRADUATE STUDIES COMMITTEE

Composition and Responsibilities

The Graduate Studies Committee consists of the Associate Chair for Graduate Studies (Chair of the GSC), the Chair of the Department & Graduate Chair (*ex officio*), the Graduate Administrator, four faculty members from the St. George campus, one faculty member from U of T at Mississauga, one faculty member from U of T at Scarborough, one representative from the Collaborative Graduate Program in Genome Biology and Bioinformatics (*ex officio*), one representative from the Collaborative Graduate Program in Developmental Biology (*ex officio*), one representative from the Collaborative Graduate Program in Neuroscience (*ex officio*), the director of the Centre for the Analysis of Genome Evolution and Function (*ex officio*), and two graduate students chosen by the Cell & Systems Biology Graduate Union in consultation with the Associate Chair for Graduate Studies. Faculty member appointments will be broadly representative of discipline areas within the department. GSC members serve a two year term and the appointments are staggered. For decision-making purposes, quorum is five (of which one must be from UTM or UTSC). The graduate student representative will not be present for any evaluations of current graduate students or for new admissions.

The GSC is responsible for:

- the formulation of policies and recommending changes in rules and regulations concerning graduate studies in the department
- admission of new students and ranking international applications
- evaluation of students for university, provincial, and federal government scholarships and fellowships
- selection of candidates for departmental awards
- approval of supervisory committees, evaluation and examination committees
- the overall supervision of graduate courses and grading practices
- reviewing student progress reports
- setting the base stipend for graduate students in the Department of Cell & Systems Biology
- the new graduate student orientation in the first week of September

Appeals

The department abides by the regulations governing appeals as set out in the General Regulations of the School of Graduate Studies. Any departmental appeals that may arise are handled at the department level by the Graduate Department Academic Appeals Committee. Consultation with the Vice-Dean, Students of the School of Graduate Studies is encouraged, prior to the beginning of any appeal process. The Vice-Dean, Students will serve as an informal mediator, attempting to resolve the dispute or clarify issues.

Students must first attempt to resolve the matter with the instructor or other person whose ruling is in question. Should the matter not be resolved and if the student wishes to pursue it, the student must discuss the matter with the Graduate Coordinator or Associate Chair of the Department. Should such discussions fail to resolve the matter, the student can make a formal appeal in writing to the Graduate Department Academic Appeals Committee.

Appendix 1: Recommended General Structure of Seminar-based Modules

For seminar-based modules, at the first pre-term organizational meeting, the day and time of the weekly seminars for the next 6 weeks is arranged based on student and faculty schedules. The module instructor (i.e., the faculty member in charge of the module) will initiate a discussion of possible topics at this first organizational meeting.

At the second meeting of seminar modules, students select topics from the list drawn up at the first meeting. If two students wish to discuss the same topic it should be possible for each of them to discuss different aspects. A timetable is drawn up of the dates when each topic will be given. Normally, the module instructor will provide the initial presentation.

Ideally, two weeks before a student presents a seminar, the student should distribute copies (or provide the web address) of the selected papers to all students and faculty who regularly attend the seminar. The student should also provide a 1-2 page summary of the contents of the papers and the questions the papers are addressing. One week before the seminar, students (and faculty) should give the student (and course instructors) a list of questions they wish to be discussed. Part of the assessment of "Contribution to Discussion" will be based on the questions given to the student and instructor.

A student speaker is expected to speak for 50-60 minutes only. The seminar should accomplish the following: scientific questions that are being considered (general/specific context), content of the paper(s) in relation to the question addressed, questions which the participants should consider. Audio visual aids should be used where appropriate.

During the discussion period, topics requiring clarification should be discussed by the speaker. The final list of questions that have been handed out should then be discussed by all participants. The speaker will act as moderator but is not expected to be "the fountain of knowledge." Participants should avoid addressing question after question to the speaker. Members of faculty will not actively lead a discussion. They may make points from time to time or clarify subject matter. Students will be assessed by faculty on their contributions to discussions.

A written assignment for seminar modules should be approximately 1,500 words, excluding tables, figures, and diagrams. Seminar module instructors may ask students to provide written work in any number of forms. Most commonly these are either in the form of a short review paper (in the style of a "Trends" or "Current Opinions" paper for example) related to a course topic, or in the form of a grant proposal on a course topic.

The module instructor (and other faculty who regularly attend the seminars) will read the essays, assess the scientific and intellectual qualities of seminar presentations, and the intellectual contributions made by students to discussions. Particular attention should be paid to the postgraduate experience of the student and whether the topic is linked to the research field of a student. The comments of the faculty on essays should be given to the students.