2016-2017 CSB Graduate Modules

Students enroll in CSB 1020H for Fall (F) 2016, Winter (S) 2017, or Summer 2017*, depending on the session the specific module is offered. This course code is used for all quarter-credit (0.25 FCE) CSB modules.
***Summer courses/modules cannot be requested on ROSI until March 20, 2017.**

Please note that each quarter-credit module has a unique teaching section, and that code must be entered when requesting a specific module on ROSI.

If you want to request two modules in the same session (e.g. Winter 2017), you will need to contact the CSB Graduate Office to arrange for enrolment in a second module.

For students in graduate programs outside of CSB, any single quarter credit module may not help complete any of your graduate program requirements.

Module: Molecular Biology of Gene Expression
CSB 1020H/F, Teaching Section LEC 0108
Coordinator: *Professor J. T. Westwood*
Offered: Fall 2016 session. Start date, Thursday October 6th, end date Thursday Nov. 17th (Nov. 10th off). Final exam on November 24th, final term paper due Nov. 28th.
Weight: One module (0.25 FCE)
Time: Thursdays, 9:30am -12:30 pm (approximately 3 hours per week)
Location: Ramsay Wright Building (Room TBA), St. George Campus
Enrolment: Limited to 10 students.

Description:
This course examines how genes are regulated in eukaryotic cells focusing on the mechanisms of gene transcription and epigenetics and the roles of transcription factors and chromatin modifying proteins. It also explores functional genomics aspects of gene expression and epigenetics- e.g. how gene expression can be monitored on a genome-wide basis using high throughput sequencing with techniques like RNA-seq, ChIP-seq and DNAse-seq. Lectures and seminars will also involve presentation and discussion of recently published research articles.

Evaluation:
Written Assignments (2 x 5 marks each)
Written Questions (2 x 2.5 marks each)
In class quizzes (2 x 2.5 marks each)
Oral Presentation (20 marks)
Written Proposal/Term Paper (25 marks)
Final Exam (open book) (30 marks)
Participation (5 marks)

Pre-requisites for module:
Third year level Molecular Biology Course

Reading materials:
Assigned Chapters from- Zlatanova, J. and van Holde, K. (2015). Molecular Biology Structure and Dynamics of Genomes and Proteomes. Garland Science. (ISBN: 9780815345589 for loose leaf version), plus other assigned readings.

Website:
Blackboard site for this course

Module: Current Techniques in Neuroscience
CSB 1020H/F, Teaching Section LEC 0124
Coordinators: *Dr. Melanie Woodin & Dr. Vince Tropepe*
Offered: Fall 2016 session.
Weight: One module (0.25 FCE)
Time: Wednesdays from 1-3 pm on November 2nd, 9th, 23rd, 30th, December 7th and 14th
Location: Ramsay Wright Building, Room TBA, St. George campus.
Enrolment: Limited to 8 students

Description:
This course will examine emerging cutting-edge techniques that are revolutionizing fundamental neuroscience research. Techniques to be investigated include: optogenetics, DREADDs, current strategies for cell-type-specific transgene expression and clonal analysis (e.g., Brainbow), genome engineering in the nervous system (e.g., CRISPR), next generation fluorescent indicators (e.g., GCamp6). 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.

Prerequisite:
At least one undergraduate course in neurobiology.

Evaluation:
Presentation 60%
Participation 40%

Presentations:
Students will work in pairs to prepare a presentation for the class on an emerging technique (listed above; groups and topics to be assigned). The presentation grade will be based on:

- Understanding of the material
- Quality of the verbal and visual presentation
- Ability to answer questions and engage the class in discussion
- Quality of a 2-page class handout (i.e. “Snapshot”)

Participation:
The mark is based on active participation at all course meetings. Students should read the assigned readings in advance and be prepared to discuss the material.

Course: Computational Genomics and Bioinformatics
Course Code: CSB 1472H/S, Teaching Section LEC 0101
Coordinator: *Professor N. Provart*
Offered: Winter 2017 session
Weight: Half credit (0.5 FCE)
Time: Wednesdays 10 am – 1 pm
Location: St. George campus, Ramsay Wright Building, Room 432
Enrolment: Limited to 10 graduate students (minimum 8 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.

The material is presented as an inverted course. Lectures are pre-recorded and available prior to class. Class time is devoted to review of the lecture material, discussion of the primary literature related to the course material, and hands-on analysis laboratories.

Recommended text: Zvelebil & Baum 2008 Understanding Bioinformatics. Garland Science, New York.

Course: Methods in Genomics and Proteomics
Course Code: CSB 1025H/S, Teaching Section LEC 0101
Coordinator: *Dr. Pauline Wang*
Offered: Winter 2017 session
Weight: Half credit (0.50 FCE)
Time: Tuesdays 12-4 pm
Location: St. George campus, Earth Sciences Centre Room 4076 & Ramsay Wright 109.
Enrolment: Limited to 2 or 3 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 ROSI.

*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 ROSI, 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, shotgun library construction, PCR, DNA sequencing, expression profiling using microarrays, 2D-gel proteome analysis, mass spectrometry and associated bioinformatics analyses such as sequence analysis and assembly, and statistical analysis of microarray 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 (60%), lab performance (25%). 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: Neuroscience of Behavioural State Control
CSB 1020H/S, Teaching Section LEC 0123
Coordinator*: Professor J. Peever*
Offered: Winter 2017 session.
Weight: One module (0.25 FCE)
Time: January and February, dates and times TBA.
Location: St. George campus, Ramsay Wright Building, Room TBA
Enrolment: Limited to 6 students

Description:
This course will examine the latest advances in how the nervous system controls behavioural states such as sleep, arousal, daily rhythms, breathing and movement. It will consider leading hypotheses on the function of the cell systems, organ systems and at the whole organism level that lead to appropriate and pathological control of such behaviours.

Evaluation:
Students will present 2 seminars, one from each section of the course. They will write a brief synopsis of the presentation. Students will also participate in discussion. Seminars and discussion will focus on issues raised in a selection of primary research papers. Written assignment: students will write a “News and Views” style review article on a current “hot topic” within the field. The subject chosen will accommodate the specific research interests of each student but must be different from those discussed in seminars.

Seminar = 20% (x2 = 40% total)
Synopsis = 10% (x2 = 20%)
Discussion = 10% (x2 = 20% total)
News and Views = 20%

Prerequisites: None
Reading Materials: to be determined by the specific interests of the participating students.

Module: Molecular Biology of Cancer
CSB 1020H/S, Teaching Section LEC 0109
Coordinator: *Professor J.T. Westwood*
Offered: Winter 2017 session, Wednesday March 1st – March 31st. Five weeks plus a final exam and term paper due at a later date.
Weight: One module (0.25 FCE)

Time: Wednesdays from 12:30 - 2 pm and Fridays from 12 – 3 pm.
Location: UTM campus, course is offered in parallel to BIO477.
Enrolment: Limited to 4 students

Description:
This course examines the molecular and genetic basis of Cancer including the role of oncogenes, tumor suppressor genes and cell cycle regulating proteins in the development of this disease. Functional genomics approaches to understanding the mechanisms of cancer will also be included. Lectures and seminars will also involve presentation and discussion of recently published research articles.

Evaluation:
Written Assignments (2 x 5 marks each)
Written Questions (2 x 2.5 marks each)
In class quizzes (2 x 2.5 marks each)
Oral Presentation (20 marks)
Written Proposal/Term Paper (25 marks)
Final Exam (open book) (30 marks)
Participation (5 marks)

Pre-requisites for module:
Third year level Molecular Biology Course. CSB Module in Gene Expression is a recommended preparatory course.

Reading materials:
Assigned Chapters from- Weinberg, R. Biology of Cancer, 2nd ed. (2013), plus other assigned articles and reviews

Website:
There will be a Blackboard site for this course (i.e. associated with BIO477 course site at the UTM campus).

Module: Evolutionary Genetic Analyses using PAML
CSB 1020H/S, Teaching Section LEC 0105
Coordinator: Professor B. Chang
Offered: Winter 2017, March / April
Weight: One module (0.25 FCE)
Time: TBA
Location: St. George campus, room TBA
Enrolment: Limited to 6 students

Description:
Covering the use of the PAML package for identifying the patterns of selection in protein coding sequence. This is meant as a workshop to analyze a sequence dataset of your choice, including both a lecture component and hands-on workshop component.

Module: **Cell Signaling in Health and Disease**
CSB 1020H/F (Summer 2017*), Teaching Section LEC 0125
Coordinator: *Professor Hai-Ying (Mary) Cheng*
Offered: Summer 2017* session, from mid-April to early June 2017 (6 weekly meetings + 1 organizational meeting)
Weight: One module (0.25 FCE)
Time: Exact dates/times to be determined (2 hour, once weekly meetings)
Location: UTM campus, room TBD
Enrolment: Limited to 6 students

Description:
This seminar-based module explores the role of key cell signaling pathways, e.g. PI3K, mTOR, Ras/MAPK, etc., in maintaining homeostasis in various physiological systems, and how their aberrant activity/function leads to a disease state. Each student will prepare and present two seminars on their assigned research articles. Students are expected to read all papers and to actively participate during classroom discussions. A final assignment involves writing a News & Views on one of the articles that the student has presented during the course module.

Evaluation: 2 seminars (30 minutes + 15 minutes for discussion)	25% each
Class participation	20%
Final written assignment (News & Views)	30%

Prerequisites: none

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Module: Cell Biology of Gastrulation
CSB 1020H/F (Summer 2017*), Teaching Section LEC 0107
Coordinators*: Professors A. Bruce & R. Winklbauer*
Offered: Summer 2017* session, from late April or early May 2017 for six weeks (plus an organizational meeting).
Weight: One module (0.25 FCE)
Time: TBA, but likely Wednesdays 5-7 pm
Location: St. George campus, Ramsay Wright Building, room TBA
Enrolment: Limited to 8 students

Description:
Gastrulation in different animals, including invertebrates and vertebrates, is used to illustrate biological processes and to discuss basic concepts in animal development. This course will explore cell behaviours that occur during migration, tissue rearrangement and spreading as well as tissue separation. In addition to discussing these cell behaviours in the context of gastrulation, we will explore other contexts in which these same or similar behaviours also occur.

Evaluation:
40% seminar (1 presentation per student on a primary research paper)
30% final presentation (group project)
10% write-up of final presentation (one per group)
20% participation in discussion

Pre-requisites for module: Some background in developmental biology as well as a strong interest in the topic.

*Summer courses cannot be requested on ROSI/ACORN until March 20, 2017.

Module: Interpreting Microscopy in Cell Biology
CSB 1020H/F (Summer 2017*), Teaching Section LEC 0116
Coordinator: *Professor Tony Harris*
Offered: Summer 2017* session, starting Thursday May 4th, 2017 for six weeks (plus an organizational meeting on Thursday April 27th from 3-4 pm).
Weight: One module (0.25 FCE)
Time: Thursdays from 3-5 pm (May 4th – June 1st), and 1-3 pm or 3-5 pm on June 15th for peer review panel discussions.
Location: St. George campus, Ramsay Wright Building, room TBA
Enrolment: Limited to 8 students

Description:
A key question in biology is how molecules work together to build cells. This question can be somewhat simplified by asking how proteins assemble large functional structures inside cells (contractile rings, belts of adhesion complexes, endomembrane systems etc.). This course will use group discussions of recent papers to consider how cutting edge imaging approaches can be used to evaluate the regulation, structures, dynamics and functions of these complexes. Additionally, basic quantification strategies for typical confocal microscopy data will be explored through hands-on analyses of raw data, and group discussions of this analysis and a proposal based on it.

Project format:
The class will be split in half and each half given a set of control and experimental images (i.e. half 1 gets data 1, and half 2 gets data 2). Each person works individually (with discussion with colleagues) to identify and quantify substantial differences between the control and experimental data. From this data, a hypothesis will be developed and three experiments will be proposed to test the hypothesis. The final report will be 4 pages, Times New Roman, double spaced, and 72 pt margins with the following headings: Title, Overview, Current Data, Experiment 1, Experiment 2, Experiment 3, Concluding Statement.

Review format:
Members of half 1 will receive the projects of half 2, and vice versa (names will be replaced with numbers). Each person will write a review for each of 3 projects. Each review will be 1 page, Times New Roman, double spaced, and 72 pt margins with the following headings: Project Number, Six-sentence summary, Major Strengths, Major Weaknesses.

Review panel format:
Half 1 will meet to discuss the half 2 projects, and then vice versa (see June 18 above). Each person will be assigned as reviewer 1, reviewer 2 or reviewer 3 for their three grants. For each project, reviewer 1 presents their full review to the group, reviewer 2 raises disagreements and fills in any gaps, and reviewer 3 raises any remaining points. Each project will be discussed for 15-20 min (Rev 1, ~7 min; Rev 2, ~ 4 min; Rev 3, ~2 min; plus general discussion). The three written reviews of each grant, and a summary of the panel discussion, will be returned to the authors as feedback.

Evaluation:
Marks: 1/3 Participation, 1/3 Project, 1/3 Reviews

Pre-requisites for module:
None

Reading materials:
Primary papers

Website:
None

*Summer courses cannot be requested on ROSI/ACORN until March 20, 2017.

Module: Integrative Physiology of Stress
CSB 1020H/F (Summer 2017), Teaching Section LEC 0101
Coordinator: *Professors L. Buck*
Offered: Summer 2017* session for six weeks between late April and May.
Weight: One module (0.25 FCE)
Time: TBA
Location: St George Campus, Ramsay Wright Building, room TBA
Enrolment: limited to 8 students

Description:
This is a seminar based course in which students will investigate the impact of environmental and pathological stress on an animal's ability to maintain homeostasis. Physiological concepts common to aspects of neurophysiology, neuroendocrinology, cellular and systemic signalling mechanisms, and mechanisms of aging will be explored in the context of major stressors.

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.

Schedule:
2 hours per week for 6 weeks
Week 1: Introductory lecture and reading assignments.
Weeks 2-5: Students presentations and discussion (2 talks/week)
Week 6: Summary Discussion

Evaluation: Students will each present a PowerPoint style presentation based on a selection of primary research papers. Presentation dates and papers will be assigned; students are expected to read all papers and participate in all discussions. However, for each presentation 2 students will be assigned the task of asking questions and leading discussion. Students will be required to write a "news and views" paper on their presentation topic or another of their choosing.

Seminar: 2 x 20-30 min, and 60 min for discussion of both papers. 40%
Participation in Discussion: 2 students assigned as major questioners/talk 20%
News & Views paper 40%

*Summer courses cannot be requested on ROSI/ACORN until March 20, 2017.

<u>Module</u>: Protein-protein interaction in complex regulatory processes
Course Code: CSB 1020H/F (Summer 2017), Teaching Section LEC 0126
Coordinator: *Professor D. Christendat*
Offered: Summer 2017 session (April - May)
Weight: 1 module (0.25 FCE)
Time: TBA
Location: St. George campus, Earth Sciences Centre, Room TBA
Enrolment: Limited to 6 students

Protein-protein interaction lies at the heart of many biological processes, including network regulation and protein turnover. We have established a large repertoire of protein-protein interaction data by interrogating biological systems with synergistic approaches: Y2H, TAP-tagging, CoiP analysis. Through the analysis of these data, we have started to understand how protein domains have evolved to participate in specific processes, such as signal transduction and metabolic pathway regulation. In this course we will look at select examples that highlight the diversity of some of the key molecular players involved, such as 14-3-3 proteins, calmodulins, ubiquitin, and kinases, and we will explore how these proteins have evolved to participate in complex regulatory processes.

This is a one module (6 sessions) course. One topic will be covered per session. Each session, one student will present three papers related to the topic. The 3rd paper will typically be a review paper. Other students will be required to submit 3 relevant questions about the papers before the start of each session. Grading will be based on participation (40%), a critique (30%) and one presentation (30%).

List of presentation topics and a meeting schedule will be discussed during the first session, TBA. Enrollment is capped at 6 graduate students.

Course: Advanced Microscopy and Imaging
Course Code: CSB 1018H/S (Summer 2017*), Teaching Section LEC 0101
Course Coordinators: *Professors Rene Harrison & Mauricio Terebiznik*. Instructors include *Professors Bebhinn Treanor, Clare Hasenkampf, and Blake Richards*
Offered: Summer 2017* session from May 9th to June 20th.
Weight: 0.5 FCE
Time: Tuesdays and Wednesdays (3-6pm)
Location: University of Toronto, Scarborough campus
Enrolment: Limited to 20 students

Description:
This graduate course will cover theory and practical demonstrations of current light, fluorescent and electron microscopy. The first four weeks of classes will have lectures and demonstrations on brightfield, epifluorescent, confocal and scanning and transmission microscopy. As well, consideration will be given to specimen preparation. Student presentations will occur in the remaining two weeks of formal classes.

Course Schedule and Structure:
We have 14 formal meetings. Each meeting is 3 hours, some sessions may not go that long. Lectures are for 1-2 hrs in most cases, then, if relevant, there is a demonstration of the particular equipment. By appointment, students arrange for training of specific equipment.

- Meetings 1-10: Lectures, Demos and Practicum
- Meetings 11-12: prarcticum examination
- Meetings 12-13: student seminar presentations (Tuesday June 20th, 3 pm-8:15 pm)
- Meeting 14: Final Exam: Wednesday June 28th, 3-6 pm

Grading Scheme:

Participation	10%
Seminar	25%
Microscopy Technical Sheet	10%
Practicums (4)	20%
Final Exam	35%

	100%

Pre-requisites: None

Reading materials: TBA

Website: There will be a Blackboard site for this course

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