

## Course Outline

### 1. COURSE INFORMATION

<b>Session Offered</b>	Winter 2017	
<b>Course Name</b>	Genomics and Proteomics	
<b>Course Code</b>	BIOTECH 4GP3	
<b>Date(s) and Time(s) of lectures</b>	Tu 10:30AM - 11:30AM Th 9:30AM - 11:30AM	
<b>Program Name</b>	Biotechnology	
<b>Calendar Description</b>	This course examines genomics, functional genomics and proteomics. Topics covered are the organization of model system genomes, gene expression profiling at the mRNA and protein levels, microarrays, analyses of interactions, genomic and proteomic databases.	
<b>Instructor(s)</b>	Dr. Fei Geng	Phone: (905) 525-9140 x20285 E-Mail: gengf@mcmaster.ca Office Hours & Location: ETB-203 Th 11:30 AM-12:20 PM Fr 12:30 PM-1:20 PM

### 2. COURSE SPECIFICS

<b>Course Description</b>	<p>In this course, students will learn to consider the molecular nature of biology from a system-wide perspective. In particular, the course will examine methods of obtaining information from entire sets of genes (i.e. genomes), proteins (i.e. proteomes), gene expression (i.e. transcriptomes), and intermolecular interactions such as protein/protein interactions (i.e. interactomes). The course will primarily focus on the laboratory techniques required to investigate these fields but will also provide a brief introduction to the mathematical, statistical and computational methods required to investigate the data produced by these techniques.</p> <p>In terms of hands-on techniques, the students will prepare samples for a gene expression microarray, will perform two-dimensional gel electrophoresis, analyze and purify proteins using high performance liquid chromatography (HPLC), and prepare protein samples for analysis by mass spectrometry (i.e. in-gel trypsinization).</p>		
<b>Instruction Type</b>	<b>Code</b>	<b>Type</b>	<b>Hours per term</b>
	C	Classroom instruction	34
	L	Laboratory, workshop or fieldwork	36
	T	Tutorial	
	DE	Distance education	
	<b>Total Hours</b>		70
<b>Resources</b>	<b>ISBN</b>	<b>Textbook Title &amp; Edition</b>	<b>Author &amp; Publisher</b>
	978-0-19-956435-4	Introduction to Genomics	Arthur Lesk Oxford University Press
	<b>Other Supplies</b>	<b>Source</b>	
	Lab goggles	Titles bookstore	
	Lab coat	Titles bookstore	
	Lab notebook	Discussed during the first lab	

<b>Prerequisite(s)</b>	BIOTECH 2M03 or 3MB3, 2BT3 or 3B03
<b>Corequisite(s)</b>	N/A
<b>Antirequisite(s)</b>	N/A
<b>Course Specific Policies</b>	<p><b>Electronic Resources</b> This course will be using a range of software. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor. The instructor may also use other software including: e-mail, Avenue, LearnLink, web pages, capa, Moodle, Thinking Cap, etc.</p> <p><b>Attendance</b> Attendance at lectures is mandatory and students will be expected to sign in for each lecture. Students may miss one presentation of a fellow student and one other lecture during the term without penalty and without the need for a McMaster Student Absence Form (MSAF) after which they will receive a deduction of 2%, 8%, 20% and 20% from the course mark for each subsequent lecture that is missed without adequate justification (i.e. an MSAF for the first absence and documentation provided from the Associate Dean's office for subsequent absences).</p> <p><b>Assignments</b> All assignments must be submitted to the instructor, online or in person depending on the assignment and as outlined in the assignment instructions, on the stated deadline dates at the stated deadline times. Late assignments submitted within 1 hour of the deadline will receive a deduction of 10% but assignments submitted after that will not be accepted and will receive a mark of 0. Note that this is the default situation. In some cases, an assignment may be designated by the instructor as a major assignment. Only in these cases, late assignments submitted within 1, 24, 48, or 72 hours of the deadline (including weekends) will receive deductions of 5%, 20%, 35% or 50% respectively but assignments handed in more than 72 hours late will not be accepted and will receive a mark of 0.</p> <p><b>Quizzes</b> Unannounced quizzes will be given periodically throughout the term during the lecture period on all recently covered course material, including lectures, assignments, online postings, readings, labs, fellow student presentations, etc. The lowest single quiz mark will be dropped from the final marks. No make-up quizzes will be allowed. Unexcused absences will result in a mark of zero for that quiz. Quizzes may involve written evaluations but may also take other formats.</p> <p><b>Presentations</b> Each student will give one individual major presentation to the class during the term. Topics will be assigned by the instructor. Instructions for on-going preparation will be given at intervals during the term (e.g. choice of a major topic, finding several candidate articles, preparing and leading a small-group discussion of your initial analysis, handing in a written description of one or two key figures/tables, the presentation itself, your analysis of other students' discussions and presentations).</p>

	<p><b>Lab</b> A three-hour lab will be performed every week in the Engineering Technology Building, room ETB 311. Students are expected to attend all labs and to submit lab reports one week after the lab is completed. Failure to attend labs and/or submit a lab evaluation without a suitable explanation will result in a grade of zero. Late submissions of lab assignments and reports without a suitable explanation will incur a penalty of 20% per school day. Students must provide their own lab coat and lab notebook as instructed.</p> <p><b>Participation</b> Participation in classroom discussions both during regular lectures and during presentations by other students will be an important part of this course.</p> <p><b>Tests</b> Students have to pass both lecture and lab components to pass this course. There will be two tests administered in the lecture period during the term. The majority of each test will be based on course material either from the beginning of the term (for test 1) or from after the previous test (for test 2) up until the current test, but may also be partly based on earlier material. The content of the tests will be readings, labs, etc.</p> <p>All tests must be written at the times announced, unless alternative arrangements have been made previously between the student and the professor to cover exceptional circumstances. Students with special needs must inform the professor through Student Accessibility Services (SAS) of their requirements five days prior to the test date so that alternative arrangements can be made.</p> <p>If you miss a test because of an emergency, you must follow university policy with respect to reporting absences on the online McMaster Student Absence Form (see below). In the event of an allowable absence, it is the student's responsibility to make arrangements with the instructor with respect to scheduling a make-up test or redistributing the weighting of evaluations over the term.</p> <p>All make-up tests are to be written at a pre-arranged date, time and place. Test questions and the method of grading may be changed, but the weight of the test will be identical to the original test.</p> <p><b>Final Exam</b> The final exam will be cumulative and will cover all course material, including the lectures, reading, assignments, material posted online, laboratory theory and student presentations. The exam will be two hours and a half in length. Students must pass the final exam to pass the course. Students must pass both components of the course – labs and lectures to pass the course.</p>
<b>Departmental Policies</b>	<p>Students must maintain a GPA of 3.5/12 to continue in the program.</p> <p>In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of “out-of-class” work for every scheduled hour in class. “Out-of-class” work includes reading, research, assignments and preparation for tests and examinations.</p> <p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>The use of cell phones, iPods, laptops and other personal electronic devices are</p>

	<p>prohibited from the classroom during the class time, unless the instructor makes an explicit exception.</p> <p>Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>	
<b>3. SUB TOPIC(S)</b>		
Week 1	<p>Introduction</p> <p>This chapter covers the key concepts in Genomics and Proteomics.</p>	Chapter 1
Week 2	<p>Genomics</p> <p>This chapter covers the mechanisms of the major Genomic sequencing technologies (Sanger sequencing and Next-Gen Sequencing).</p>	Chapter 3
Week 3	<p>Genomics (cont'd)</p> <p>This chapter covers the whole process of Genome analysis and the applications.</p>	Chapter 4
Week 4	<p>Transcriptomics and Microarrays;</p> <p>This chapter covers the mechanisms of Transcriptomics and the design of Microarrays.</p>	Chapter 9
Week 5	<p>Proteomics, Chromatography and Mass Spectrometry</p> <p>This part of the chapter covers the key concepts in Proteomics, Chromatography and Mass Spectrometry.</p>	Chapter 10
Week 6	<p>Proteomics, Chromatography and Mass Spectrometry (cont'd)</p> <p>This part of the chapter covers the key applications in Proteomics, Chromatography and Mass Spectrometry.</p>	Chapter 10
Mid-term Recess: Monday, February 20 to Sunday, February 26, 2017		
Week 7	<p>Interactomics and Protein/Protein Analysis</p> <p>This part of the chapter covers the key concepts in Interactomics and the major applications.</p>	Chapter 11
Week 8	<p>Interactomics and Protein/Protein Analysis (cont'd)</p> <p>This part of the chapter covers the mechanisms in the technologies which handles Protein-Protein analysis and the applications.</p>	Chapter 11
Week 9-13	<p>Students will give their presentations over the latter five weeks of the course. Interspersed between student presentations will be the following special topics presented by the instructor:</p> <ul style="list-style-type: none"> <li>• Absolute Quantitation of Protein Abundance by Mass Spectrometry</li> <li>• Analysis of Post-Translational Protein Modifications by Mass Spectrometry</li> <li>• High-Throughput Protein Structure Determination</li> </ul> <p>A System-Wide Approach to Molecular Biology</p>	N/A
<p>Classes end: Thursday, April 6, 2017</p> <p>Final examination period: Tuesday, April 11 to Thursday, April 27, 2017</p> <p>All examinations MUST be written during the scheduled examination period.</p>		
<b>List of experiments</b>		
Lab 1	Introduction	

Lab 2	HPLC-Based Protein Purification & Analysis
Lab 3	Yeast Lysis and Fraction Collector
Mid-term Recess: Monday, February 20 to Sunday, February 26, 2017	
Lab 4	Microarrays
Lab 5	2D Gel Electrophoresis
Lab 6	In-Gel Digestion of Protein Samples with Trypsin and Mass Spectrometry analysis

Note that this structure represents a plan and is subject to adjustment term by term.

The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. ASSESSMENT OF LEARNING	Weight
Quizzes and case studies	10%
Presentation (oral presentation for 4%, a written report to be submitted after the presentation for 1%)	5%
Labs (prelab quizzes 5% and lab reports 20%)	25%
Term Test 1	15%
Term Test 2	15%
Final Examination	30%
<b>TOTAL</b>	<b>100%</b>

Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES
1. Discuss molecular biology from the perspective of both individual components, from the perspective of complete sets of analytes (e.g. sets of genes, transcripts, proteins, etc.), and a "systems-wide" perspective, explaining the similarities and differences between the different approaches.
2. Understand, present and discuss a detailed analysis of one particular "-omics" field/sub-field and one particular example of a study/project/technological development within that field.
3. Create a preliminary list of specific and general classes of bioinformatics tools that are necessary or helpful in analyzing data acquired from "-omics" analysis.
4. Discuss the rapid changes that are occurring in the broader fields of molecular biology and biochemistry, including discussions of changes in technology, implications for styles of research and types of questions that can be asked, requirements for data analysis tools and understanding, and technological and cost and ethical issues for society-at-large.
5. Perform several important laboratory techniques relevant to a systems-wide analysis of organisms, including microarrays, hplc-based protein analysis/purification, two-dimensional gel electrophoresis, and preparation of protein samples for mass spectrometry.

6. POLICIES
<b>Anti-Discrimination</b>
The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible. <a href="http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&amp;Response.pdf">http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&amp;Response.pdf</a>

Academic Integrity
You are required to exhibit honestly and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, located at: <http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf>.

The following illustrates only three forms of academic dishonesty:

1. Plagiarism. E.g. the submission of work that is not own or for which other credit has been obtained
2. Improper collaboration in group work
3. Copying or using unauthorized aids in tests and examinations.

### **Requests for Relief for Missed Academic Term Work (Assignments, Mid-Terms, etc.)**

The McMaster Student Absence Form is an on-line self-reporting tool for **Undergraduate Students** to report absences for:

- 1) Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:
  - Students may submit a maximum of one academic work missed request per term. It is the responsibility of the student to follow up with instructors immediately (within the 3 day period that is specified in the MSAF) regarding the nature of the accommodation. All work due in that time period however can be covered by one MSAF.
  - MSAF cannot be used to meet religious obligation or celebration of an important religious holiday, for that has already been completed or attempted or to apply for relief for any final examination or its equivalent.
- 2) For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has not been used previously in that term:

Students must visit their Associate Dean's Office (Faculty Office) and provide supporting documentation.

### **E-Learning Policy**

Consistent with the Bachelor of Technology's policy to utilize e-learning as a complement to traditional classroom instruction, students are expected to obtain appropriate passwords and accounts to access Avenue To Learn for this course. Materials will be posted by class for student download. It is expected that students will avail themselves of these materials prior to class. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail account, and program affiliation may become apparent to all other students in the course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about this disclosure please discuss this with the course instructor. Avenue can be accessed via <http://avenue.mcmaster.ca>.

### **Communications**

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.

- Check the McMaster/Avenue email and course websites on a regular basis during the term.

### **Turnitin (Optional)**

This course will be using a web-based service (Turnitin.com) to reveal plagiarism. Students submit their assignment/work electronically to Turnitin.com where it is checked against the internet, published works and Turnitin's database for similar or identical work. If Turnitin finds similar or identical work that has not been properly cited, a report is sent to the instructor showing the student's work and the original source. The instructor reviews what Turnitin has found and then determines if he/she thinks there is a problem with the work. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to

<http://www.mcmaster.ca/academicintegrity/turnitin/students/>

### **Protection of Privacy Act (FIPPA)**

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades and all other personal information at all times. For example, the submission and return of assignments and posting of grades must be done in a manner that ensures confidentiality.

<http://www.mcmaster.ca/univsec/fippra/fippra.cfm>

### **Academic Accommodation of Students with Disabilities Policy**

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail [sas@mcmaster.ca](mailto:sas@mcmaster.ca). For further information consult McMaster's policy for Academic Accommodation of Students with Disabilities

<http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf>

Students must forward a copy of the SAS accommodation to the instructor of each course and to the Program Administrator of the B.Tech. Program immediately upon receipt. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. <http://sas.mcmaster.ca>

### **Student Code of Conduct**

The Student Code of Conduct (SCC) exists to promote the safety and security of all the students in the McMaster community and to encourage respect for others, their property and the laws of the land. McMaster University is a community which values mutual respect for the rights, responsibilities, dignity and well-being of others. The purpose of the Student Code of Conduct is to outline accepted standards of behavior that are harmonious with the goals and the well-being of the University community, and to define the procedures to be followed when students fail to meet the accepted standards of behavior. All students have the responsibility to familiarize themselves with the University regulations and the conduct expected of them while studying at McMaster University.

[http://studentconduct.mcmaster.ca/student\\_code\\_of\\_conduct.html](http://studentconduct.mcmaster.ca/student_code_of_conduct.html)