McMaster University ENGINEERING | mohawk | W BOOTH SCHOOL OF ENGINEERING PRACTICE AND TECHNOLOGY
McMaster-Mohawk Bachelor of Technology Partnership

Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2017	
Course Name	Molecular Biology	
Course Code	BIOTECH 2M03	
Date(s) and Time(s) of lectures	Mo 14:30-16:20, Th 10:30-11:20	
Program Name	Biotechnology	
Calendar Description	Principles of molecular biology that form the basis of nucleic acid and protein based methodologies. DNA replication, repair and recombination; bacterial and eukaryotic transcription and RNA processing; translation; and regulation of gene expression.	
Instructor(s)	Lecture instructor: Dr. Fei Geng	E-Mail: gengf@mcmaster.ca Office Hours & Location: Monday 12:30-14:20, Wednesday 12:30-14:20 ETB203
	Lab instructor: Dr. Asif Mohammad	E-Mail: amohamm@mcmaster.ca
	Lab instructor: Dr. Ana Tomljenovic-Berube	E-Mail: tomljeam@mcmaster.ca

2. COURSE SPECIFICS

Course Description

In this course, students will be given an in-depth exposure to the fundamental processes that underlie the organization and expression of genetic information in all living organisms. These include the copying and maintenance of the information found in DNA (replication and repair), its "expression" via selective conversion to RNA (transcription), and the production of proteins (the major molecular machines of the cell) from that information (translation). The students will learn the important pathways involved in those processes, the molecular components that comprise them and some of the important means by which they are regulated. The students will be introduced to key proteins involved in controlling cell division and signalling within and between cells. They will also learn a few of the ways in which disease results when some of these pathways are misregulated. In the laboratory, the students will learn techniques involved in the production, purification, quantification, and characterization of DNA and protein molecules.

Instruction Type

Code	Type	Hours per term
C	Classroom instruction	34
L	Laboratory, workshop or fieldwork	36
T	Tutorial	0
DE	Distance education	0
	Total Hours	70

Resources

ISBN	Textbook Title & Edition	Author & Publisher
978-0-470-48337-4	**Cell and Molecular Biology: Concepts and Experiments 6th edition**	**Gerald Karp, John Wiley & Sons, Inc., 2010**
Other Supplies	**Source**	

	Lab goggles, lab coat and lab notebook	**Titles Bookstore**
Prerequisite(s)	ENGTECH 1BI3, ENGTECH 1CH3	
Corequisite(s)	N/A	
Antirequisite(s)	BIOTECH 3MB3	
Course Specific Policies	**Electronic Resources** 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. Access to certain course files, in particular the lab manual, will require that you use an up-to-date web browser when you use Avenue2Learn, all of which are available as free downloads/upgrades on the internet. These include Firefox 15.0, Opera 12.0, Chrome 21.0, and Internet Explorer 9.0. In particular, you should not use Internet Explorer 8 or earlier versions. Also, note that the Safari web browser is not compatible with some course files. **Attendance** Attendance at lectures is mandatory and students will be expected to attend each lecture. Attendance at labs is mandatory. If you miss a lab and do not provide an MSAF for the missed lab (or other appropriate official documentation if you have already used your MSAF) you will still receive your given mark for any pre-lab work you had already handed in but you will receive a zero for the lab itself and any post-lab work (reports, on-line questions, etc.) that was to be handed in later. **Assignments** 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. These will be identified during term. Only in these cases, late assignments submitted within 1, 24, 48, or 72 hours of the deadline (including weekends) will receive deductions of 2%, 10%, 25% or 50% respectively but assignments handed in more than 72 hours late will not be accepted and will receive a mark of 0. **Quizzes** 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. **Tests** 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 based on all course material, including lectures, assignments, online postings, readings, labs, etc. 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. 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). No make-up policy for this course. In the event of an allowable absence, the weighting of any missed test over the term will be compensated in the final exam. **Lab** A three-hour lab will be performed every week at Mohawk College in the Organic Chemistry lab on the third floor of E wing. Directions will be provided. Lab attendance and policy on late submissions is described above. Students are expected to attend all labs and to submit lab assignments and reports as instructed. Students must provide their own lab coat, lab goggles and lab notebook as instructed. **Final Exam** 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 three hours in length. Students must pass both components of the course – labs and lectures to pass the course.	
Departmental Policies	Students must maintain a GPA of 3.5/12 to continue in the program. 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. Where group work is indicated in the course outline, such collaborative work is mandatory. The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception. 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. Instructor has the right to submit work to software to identify plagiarism.	
3. SUB TOPIC(S)		
Week 1	Structure of Genes & Chromosomes -the units of inheritance -chromosomes: genetics & recombination -the structure of DNA	Chapter 10
Week 2	Genome Structure & Stability -DNA supercoiling -genome complexity & modification -genetic variation & comparative genomics	Chapter 10

	Quiz1	
Week 3	Gene Expression Overview -from genes to proteins -transcription -ribosomal & transfer RNA synthesis	Chapter 11
Week 4	Transcription Products -the transcriptional machinery -messenger RNA synthesis & processing -small regulatory RNAs **Quiz2**	Chapter 11
Week 5	Translation -the genetic code -stages of translation -mRNA surveillance **Term Test 1**	Chapter 11
Mid-term Recess: Monday, October 9 to Sunday, October 15, 2017		
Week 6	The Eukaryotic Nucleus -chromosomes & chromatin **Quiz3**	Chapter 12
Week 7	Control of Gene Expression in Bacteria -control of gene expression -operons -transcription factors	Chapter 12
Week 8	Control of Gene Expression in Eukaryotes -enhancers, promoters & coactivators -regulation of mRNA processing -translational control **Quiz4**	Chapter 12
Week 9	DNA Replication -bacterial replication -DNA polymerases **Term Test 2**	Chapter 13
Week 10	The Cell Cycle -DNA repair -cell cycle regulatory proteins -checkpoints	Chapter 14
Week 11	Cell Signaling -extra- & intracellular messengers & receptors -G-protein coupled receptors -tyrosine phosphorylation **Quiz5**	Chapter 15
Week 12	Cancer -tumour suppressors -oncogenes -cancer therapies	Chapter 16
Classes end: Wednesday, December 6, 2017 Final examination period: Friday, December 8 to Thursday, December 21, 2017 All examinations MUST be written during the scheduled examination period.		
List of experiments		
Lab 1	Lab Safety and Molecular Biology Lab Fundamentals	

Lab 2	Expt 1 - Micropipette, Microfuge and Electrophoresis Exercises
Lab 3	Expt 2 - DNA Extraction from Onion or Wheat Germ
Lab 4	Expt 3 - Competent Bacteria Preparation and Transformation
Lab 5	Expt 4 - Plasmid DNA Mini-Preparation
Mid-term Recess: Monday, October 9 to Sunday, October 15, 2017	
Lab 6	Expt 5 - Agarose Gel DNA Quantification and Restriction Mapping
Lab 7	Expt 6 - Thin Layer Chromatography of Amino Acids
Lab 8	Expt 7 - Total Protein Assays
Lab 9	Expt 8 - DNA Melting Curve Analysis
Lab 10	Expt 9 - SDS Polyacrylamide Gel Protein Electrophoresis
Lab 11	Expt 10 - Principles of the Polymerase Chain Reaction (PCR)

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 *including dates*	**Weight**
Participation	**5%**
Quizzes	**5%**
Presentation	**5%**
Midterm 1	**15%**
Midterm 2	**15%**
Labs	**25%**
Final Exam	**30%**
TOTAL	**100%**

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

5. LEARNING OUTCOMES

Upon completion of this course, students will be able to:

1. summarize the biochemical pathways involved in DNA replication and repair, transcription and translation, including the identities and roles of the important molecules and multi-molecular complexes involved in those processes,

2. explain the most important aspects of the regulation of these processes,

3. outline some of the important pathways and proteins involved in cell cycle control and cell signaling,

4. describe ways in which fundamental molecular pathways are perturbed in select diseases, including cancer,

5. list the reagents, operate the equipment and perform the procedures involved in molecular biology laboratory techniques, including:

- liquid transfer (especially micropipetting),
- separation of molecular mixtures (including DNA and protein gel electrophoresis, and column and thin layer chromatography),
- purification of DNA and protein from biological sources,
- quantification of amounts and molecular sizes of DNA and proteins,
- mapping of DNA sequences using restriction enzymes, and
- characterization of parameters affecting catalytic activity of protein enzymes.

6. POLICIES

Anti-Discrimination

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.
http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

Academic Integrity

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

Academic dishonesty is to knowingly act of 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/fippa/fippa.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. 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://judicialaffairs.mcmaster.ca/pdf/SCC.pdf and http://www.mcmaster.ca/policy/Students-AcademicStudies/StudentCode.pdf