

Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2023	
Course Name	Molecular Biology	
Course Code	BIOTECH 2M03	
Date(s) and Time(s) of lectures	Th 9:30-11:20 am, Fr 12:30-1:20 pm	
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 12:30-13:20, Wednesday 12:30-13:20 ETB203
	Lab instructor: Dr. Asif Mohammad	E-Mail: amohamm@mcmaster.ca Office Hours & Location: Thu 11:30am-12:20pm or by appointment, ETB/209 or via zoom

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 6 th 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	<p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>	

	<p>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>Tests</p> <p>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.</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). 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.</p> <p>Lab</p> <p>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.</p> <p>Final Exam</p> <p>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.</p>
<p>Departmental Policies</p>	<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 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>

3. SUB TOPIC(S)		
Week 1	Introduction	Chapter 10
Week 2	Structure of Genes & Chromosomes -the units of inheritance -chromosomes: genetics & recombination -the structure of DNA	Chapter 10
Week 3	Genome Structure & Stability -DNA supercoiling -genome complexity & modification -genetic variation & comparative genomics Quiz1	Chapter 11
Week 4	Gene Expression Overview -from genes to proteins -transcription -ribosomal & transfer RNA synthesis	Chapter 11
Week 5	Transcription Products -the transcriptional machinery -messenger RNA synthesis & processing -small regulatory RNAs Quiz2	Chapter 11
Mid-term Recess: Monday, October 9 to Sunday, October 15		
Week 6	Translation -the genetic code -stages of translation -mRNA surveillance Term Test 1	Chapter 12
Week 7	The Eukaryotic Nucleus -chromosomes & chromatin Quiz3	Chapter 12
Week 8	Control of Gene Expression in Bacteria -control of gene expression -operons -transcription factors	Chapter 12
Week 9	Control of Gene Expression in Eukaryotes -enhancers, promoters & coactivators -regulation of mRNA processing -translational control Quiz4	Chapter 13
Week 10	DNA Replication -bacterial replication -DNA polymerases Term Test 2	Chapter 13
Week 11	DNA Replication -DNA repair -cell cycle regulatory proteins Quiz5	Chapter 15

Week 12	Review	Chapter 10-13
---------	--------	---------------

Classes end: Thursday, December 8, 2022

Final Examination Period: Friday, December 9 to Thursday, December 22
All examinations MUST be written during the scheduled examination period.

List of experiments

Lab 1	Lab Safety and Molecular Biology Lab Fundamentals
Lab 2	Experiment 1 - Micropipette, Microfuge and Electrophoresis Exercises
Lab 3	Experiment 2 - DNA Extraction from Onion or Wheat Germ
Lab 4	Experiment 3 - Competent Bacteria Preparation and Transformation
Lab 5	Experiment 4 - Plasmid DNA Preparation
Mid-term Recess: Monday, October 9 to Sunday, October 15	
Lab 6	Experiment 5 - Agarose Gel DNA Quantification and Restriction Mapping
Lab 7	Experiment 6 - Thin Layer Chromatography of Amino Acids
Lab 8	Experiment 7- Total Protein Assays
Lab 9	Experiment 8 - DNA Melting Curve Analysis
Lab 10	Experiment 9- SDS Polyacrylamide Gel Protein Electrophoresis
Lab 11	Experiment 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
Quizzes	10%
Presentation	5%
Midterm 1	15%
Midterm 2	15%
Labs	25%
Final examination (tests cumulative knowledge)	30%
TOTAL	10%

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. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

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 expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. It is your responsibility to understand what constitutes academic dishonesty.

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. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty: The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster’s use of Turnitin.com, please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, 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 a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

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.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests. <http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf>

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.