

IBEHS 2P03 Syllabus

ADMINISTRATIVE DETAILS

COURSE INSTRUCTOR:

Dr. Vincent Leung

leungv@mcmaster.ca

Office: JHE-A412

Office Hours: By Appointment

WET LAB TECHNICIAN:

Andrej Rusin

rusina@mcmaster.ca

Office: HSC 4H13

TEACHING ASSISTANTS

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Taha Parvez

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EMAIL POLICY

Every attempt will be made to reply within 24 hours (excluding weekends). Please include a subject prefix of "IBEHS 2P03". Emails must be sent from your @mcmaster.ca account. Be sure to include your student number in your email.

COURSE DESCRIPTION

This course is designed to introduce students to Genetic Engineering in the Health Sciences, from a molecular research perspective. It engages students in laboratory related skills specific to genetic engineering. IBEHS 2P03 is also a Design Project course built to emphasize a tight-knit community of students, staff and teaching assistants working together on a semester-long Genetic Health Solutions project. The students will form groups on week 1 and choose a health problem. Each week, fundamental synthetic biology topics will be discussed in lectures and students will participate in Design Tutorials and Wet Lab Experiments aimed at developing the skills and knowledge required for completing the Design Project. Presenting work at a scientific conference is essential any molecular engineer so students will get the chance to write a Scientific Paper and present their work at the end of the term.

LECTURES: Tuesday/Thursday 11:30 - 12:20 (MDCL 1105)

DESIGN TUTORIALS (MDCL 1009)/LABORATORIES (HSC 4H13):

Section	Date and Time	TA 1	TA 2	TA 3
L01	Mon 8:30-11:20	Amy		
L02	Tues 8:30-11:20	Adam	Taha	Luckshann
L03	Mon 14:30-17:20	Carmine	Michelle	
L04	Tues 14:30-17:20	Anushree	Fahad	Alex
L05	Wed 8:30-11:20	Mosana		

TIMETABLE:

Week	Week of	Lectures	Design Tutorials (DT) /Wet Labs (WL)
1	Jan. 10	Module 0: Introduction to the Course	No DT or VL
2	Jan. 17	Module 2: Intro to Synthetic Biology	DT-1: Team Formation & Intro to Design Project Design thinking, Technical Communication, Central dogma,
3	Jan. 24	Module 2: Intro to Synthetic Biology	WL-1: Lab Safety, Instruments, Pipette Training, & Bacterial Cell Culture/ DT-2: Intro to Benchling
4	Jan. 31	Module 3: Intro to Molecular Cloning	WL-1: Lab Safety, Instruments, Pipette Training, & Bacterial Cell Culture/ DT-2: Intro to Benchling
5	Feb. 7	Module 3: Intro to Molecular Cloning	WL-2: PCR Amplification of the <i>amiICP</i> Gene & Gel Electrophoresis
6	Feb. 14	Module 3: Intro to Molecular Cloning	WL-3: Molecular Cloning – Restriction Digests, Ligation, & Transformation
7	Feb. 21	Break	Break
8	Feb. 28	Module 3: Intro to Molecular Cloning	WL-4: An introduction to BioBricks & Plasmid Miniprep
9	Mar. 7	Module 4: Modeling Biological Systems	WL-5: BioBrick Assembly and Transformation
10	Mar. 14	Module 4: Modeling Biological Systems	DT-3: Constructing a Circuit in SimBiology
11	Mar. 21	Module 4: Modeling Biological Systems	DT-4: Building the Design Project Model
12	Mar. 28	Module 5: Bioethics	DT-5: Report Writing and Presentation
13	Apr. 4		DP Presentation

*Dates subject to change **with** notice

LEARNING OUTCOMES

Upon successful completion of the course, the student should be able to:	
LO.01	Apply the elements of engineering design to manipulate DNA (genetic material)
LO.02	Use software and computer aided design effectively for <i>in silico</i> genetic engineering
LO.03	Appreciate the breadth of genetic engineering applications in the Health Sciences
LO.04	Demonstrate effective application of Biochemical experimental design processes
LO.05	Explain the health and safety responsibilities of a professional bioengineer
LO.06	Learn the core skills and tools to perform hands-on genetic engineering
LO.07	Demonstrate self-directed, problem-based learning skills
LO.08	Demonstrate effective scientific and technical communication, both orally and in writing
LO.09	Demonstrate effective contributions as a significant member of a Design Team
LO.10	Develop a mathematical model for a biological system

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only, and will not be directly taken into consideration in determining a student's actual grade in the course.

Learning Outcomes	Indicators
LO.01 Apply the elements of engineering design to manipulate DNA (genetic material)	1.4, 4.3
LO.02 Use software and computer aided design effectively for <i>in silico</i> genetic engineering	3.2
LO.03 Appreciate the breadth of genetic engineering applications in the Health Sciences	1.2, 12.2
LO.04 Demonstrate effective application of Biochemical experimental design processes	1.4, 2.1, 4.1
LO.05 Explain the health and safety responsibilities of a professional bioengineer	8.1, 9.1, 10.1
LO.06 Learn the core skills and tools to perform hands-on genetic engineering	3.3
LO.07 Demonstrate self-directed, problem-based learning skills	12.1
LO.08 Demonstrate effective scientific and technical communication, both orally and in writing	7.3
LO.09 Demonstrate effective contributions as a significant member of a Design Team	6.2
LO.10 Develop a mathematical model for a biological system	2.3, 3.2

TEXTBOOKS & MATERIALS

REQUIRED TEXTS

None

OPTIONAL TEXTS

This course does not have a textbook, the following guidebook is available for free and will be helpful as a primer to synthetic biology: *Synthetic Biology Guidebook for iGem High School*

http://igem.org/wiki/images/7/71/AITF_iGEMHS_Guidebook_Final.pdf

REQUIRED SOFTWARE

1. MATLAB (www.mathworks.com)
 - a. SimBiology Toolbox
2. Benchling (free software)
 - a. Register an account using your email
 - b. Activate your account by opening the link sent to your email
 - c. Click through the survey questions and then download will be made available

PERSONAL LAB SAFETY GEAR

Every student needs a lab coat and safety glasses/goggles. Masks must be worn in the lab. Gloves will be provided.

CALCULATOR

Any calculator may be use during tests and exams.

ONLINE MANAGEMENT

The Course Management System will be Avenue to Learn (<http://avenue.mcmaster.ca/>). The student is expected to check the system daily.

INCLUSIVE ENVIRONMENT STATEMENT

We consider this classroom to be a place where you will be treated with respect, and we welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

We will gladly honour your request to address you by an alternate name or gender pronoun. Please advise us of this preference early in the semester so that we may make appropriate changes to our records.

COURSE OVERVIEW, ASSESSMENT & IMPORTANT DATES

WET LAB AND DESIGN TUTORIAL ATTENDANCE

Students have been assigned specific Wet Lab and Design Tutorial sections. When attending Wet Labs and Design Tutorials, students must attend the assigned room and section. Any assessment completed by a student in a different section other than the one assigned will not be graded.

WET LABS AND EQUITABLE DIVISION OF WORK

In the wet labs, you will routinely work in groups of two or four at your station. Everyone in **your lab group is responsible for ensuring that there is an equitable division of work in your experiments**. For example, in a group of four, one pair of students may be assigned to set up digestion reactions while the other pair observes and takes notes. Later in the lab, it may be agreed upon that the two students who first took notes may be assigned to performing purification of the digests. Further still, some tasks will invariably involve the whole group. While we will not be able to monitor division of work during the labs and cannot prescribe specific guidelines, it is not acceptable for one or two people in a group to do all or most of the experimental work in a given lab. **You and your group members will be required to fill out a peer work review form at the end of the labs—this form will be used to determine your lab participation grade.** This will be done to ensure that the lab work is shared equitably between group members.

SUBMISSION OF WORK

It is the student's responsibility to ensure assessments are correctly submitted to correct location (e.g. handed in to TA, Avenue Dropbox, Portfolio, etc.), on time, and in the specified format. **Failure to correctly submit an assignment will result in a mark deduction.** Grades for Lab Assignments, Design Project work, and Milestones will be posted to Avenue within 7 days after submission. **You will have 7 days from the date of return to address any concerns you may have to the Course Instructor or your Lab TA.**

SUBMISSION PENALTIES

Please be aware of the following penalties for Milestones and Assignments:

- Design Project Milestones:
 - Milestone Reports, MATLAB simulations, Poster drafts etc. – unless explicitly indicated all Design Project work is to be submitted to the correct dropbox on Avenue to Learn. They must be **submitted by 11:59 pm** on deadline day to be considered for grading. A penalty of 20% per day late will be applied for any late submissions.
- Design Tutorial Assignments:
 - Assignments are to be submitted to the correct dropbox on Avenue to Learn. They must be **submitted by 11:59 pm** on deadline day to be considered for grading. A penalty of 20% per day late will be applied for any late submissions.
- Wet Labs Assignments:
 - Wet Lab Assignments must be completed **by 11:59 pm** on the deadline day to be considered for grading. Late completions will be assessed a of 20% per day late.

- General:
 - It is your responsibility to ensure any electronic submissions can be opened by the TA (submit as single PDF file). Submissions that cannot be opened will not be graded.
 - Any Submissions deemed to be partially or fully copied will be considered an academic offence and be subject to terms laid out under the Academic Integrity Policy

CUMULATIVE ASSESSMENTS AND EXAMS

All Cumulative Assessments and Tests **must be submitted and completed**. Failure to do so will result in a final grade of F with the notation DNW (Did Not Write). In a case where the component weight cannot be fulfilled as a result of unforeseen and/or uncontrollable circumstance(s) in the course operation or execution, the grades assigned to that component will be pro-rated.

ASSESSMENT

FINAL GRADE COMPONENT	WEIGHT
Design Project	50%
Milestone 1	(5%)
Milestone 2	(5%)
Milestone 3	(10%)
Milestone 4	(10%)
Milestone 5	(15%)
Milestone 6	(3%)
Peer Evaluation	(2%)
Tutorial and Lab Assignments	20%
4 Wet Lab Assignments (2% each)	(8%)
Lab Report	(5%)
DT-2 Assignment	(2%)
DT-3 Assignment	(5%)
Exams/Tests	30%
Final Exam	(30%)

*Assessment weighting subject to change **with** notice

MILESTONE SCHEDULE

Description	Due Date
M1: Problem Background and Biological Parts Selection	Monday, February 7
M2: Materials and Methods	Monday, February 28
M3: SimBiology Model of Circuit	Monday, March 28
M4: Poster Presentation	Week of April 4
M5: Scientific Journal Article	Monday, April 11

M6: Project Reflection

Wednesday, April 13

*Dates subject to change **with** notice.

ACCREDITATION

The Graduate Attributes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's actual grade in the course. For more information on Accreditation, please visit: <https://www.engineerscanada.ca>. Mapping of the Learning Outcomes listed above to the Canadian Engineering Accreditation Board (CEAB) Graduate Attributes can be obtained from the Instructor.

ACADEMIC POLICIES

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.

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 types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. submission of work not one's own or which other credit been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

In this course we will be using a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. Students will be expected to submit their work electronically either directly to Turnitin.com or via Avenue to Learn (A2L) plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish to submit their work through A2L and/or Turnitin.com must still submit an electronic and/or hardcopy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com or A2L. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). To see the Turnitin.com Policy, please go to www.mcmaster.ca/academicintegrity.

ON-LINE ACCESS

In this course, we will be using Avenue-to-Learn. 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.

ACADEMIC ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

REQUEST FOR RELIEF FOR MISSED ACADEMIC 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”

1. All MSAFs are to be directed to ibio2p03@mcmaster.ca. Sending to another email address will delay processing.
2. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
 - In the event an MSAF is applied to the following lab assessments/assignments, **they will be rescheduled:**
 - End-of-Year Cumulative Assessments (e.g. Poster Presentation, Final Report)

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 requiring a RISO accommodation 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.

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and 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 (e.g., severe weather, labour disruptions, etc.). 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. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of

the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to <https://reo.mcmaster.ca/>.

PEDAGOGICAL STUDY

For the study of engineering education, you may be asked to provide information or feedback about course components. When possible, the instructor will share these results with participants.

COURSES WITH ONLINE 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

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.

Integrated Biomedical Engineering & Health Sciences (IBEHS) Labs/Design Studio Safety

Information for Laboratory Safety and Important Contacts

This document is for users of IBEHS instructional laboratories at the following locations:

- ETB - 533/534 (Medical Imaging & Medical Instrumentation Labs)
- ABB - C104 (Design Studio)
- HSC - 4N72 (Genetic Engineering Lab)

This document provides important information for the healthy and safe operation of IBEHS instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in IBEHS. It is expected that revisions and updates to this document will be done continually. A McMaster University [lab manual](#) is also available to read in every laboratory.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.
4. Proper and safe use of lab equipment should be known before using it.
5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.
9. [Personal ergonomics](#) should be practiced when conducting lab work.
10. [Current University health and safety](#) issues, and protocols should be known.

Location of Safety Equipment

Fire Extinguisher

On walls in halls outside of labs or
ABB C103/A

First Aid Kit

ETB 534/A, ABB C103/A, HSC 4N72 or dial
"88" after 4:30 p.m.

Telephone

On the wall of every lab near the door

Fire Alarm Pulls

Near all building exit doors on all floors

Who to Contact

Emergency Medical / Security:

On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.

Hospital Emergency Medical / Security:

For McMaster HSC, call Security at extension **5555** or **905-521-2100** from a cell phone.

Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.

University Security (Enquiries / Non-Emergency):

Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.

See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs.

Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.

IBEHS Specific Instructional Laboratory Concerns: For non-emergency questions specific to the IBEHS laboratories, please contact appropriate personnel below from a McMaster phone...

- Leela Pilli – 26888
- Parmveer Bola – 23521
- Alexa Huang – 24548

In Case of a Fire (Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire

Do not use a fire extinguisher on people.

1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents.

Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:

1. Immediately discontinue use of the equipment.
2. In Power Lab, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

Protocol for Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you're not sure, ask!

Defined Roles

TA	The first point of contact for lab supervision	
IBEHS Lab Technician	Leela Pilli	pillil@mcmaster.ca
IBEHS Instructional Assistant	Parmveer Bola	bolap1@mcmaster.ca
IBEHS Co-Directors	Dr. Greg Wohl	wohlg@mcmaster.ca
	Dr. Michelle MacDonald	macdonml@mcmaster.ca
IBEHS Administrator	Alexa Behar-Bannelier	huanga2@mcmaster.ca
IBEHS Course Instructor	Please contact your specific course instructor directly	