

**MDSC 408**  
**Research Design in Molecular Biology and Bioinformatics**

**Instructors:**

Dr. Guido van Marle, M.Sc., Ph.D. **(Course Coordinator)**

Phone: (403) 210-3923

E-mail: [vanmarle@ucalgary.ca](mailto:vanmarle@ucalgary.ca)

Dr. Mayi Arcellana-Panlilio, Ph.D.

E-mail: [myarcell@ucalgary.ca](mailto:myarcell@ucalgary.ca)

**Laboratory supervisor:**

Deirdre Lobb

Room 2529A, Health Sciences Centre

Phone: (403) 210-8156

E-mail: [dadracas@ucalgary.ca](mailto:dadracas@ucalgary.ca)

**Office Hours/Policy on Answering Student Emails**

Office Hours are by appointment only. The instructors will respond to emails received during working hours by the next working day.

**Teaching Assistants:**

Laboratory TAs:

Md Abu Nasar Mohon (Mohon)

E-mail: [manmohon@ucalgary.ca](mailto:manmohon@ucalgary.ca)

Grace Hudson

E-mail: [gmhudson@ucalgary.ca](mailto:gmhudson@ucalgary.ca)

Keith Lau

E-mail: [kcklau@ucalgary.ca](mailto:kcklau@ucalgary.ca)

Leah Hohman

E-mail: [Leah.hohman@ucalgary.ca](mailto:Leah.hohman@ucalgary.ca)

Bioinformatics TAs:

Carly Pontifex

Email: [cspontif@ucalgary.ca](mailto:cspontif@ucalgary.ca)

Wisoo Shin

Email: [wshin@ucalgary.ca](mailto:wshin@ucalgary.ca)

**Time and Location:****TERM:** Fall 2019 and Winter 2020**TIME:** Tuesdays and Thursdays, 9:00-11:50 AM**LECTURES:** HSC1501/HSC1500**LABS:** HSC 2525A, 2525B, 2526A & 2526B

Please consult course schedule to confirm location of individual sessions.

**Prerequisite/Co-Requisite:**

MDSC 308 and admission to the BHSc Honours program

**Course Description:**

An introduction to the research methods utilized in the Health Sciences. Students will begin to develop the knowledge and skills necessary to conduct research in their respective fields. The importance of research design, qualitative, quantitative and mixed methods and the theoretical constructs that inform these approaches will be emphasized.

**Overarching Theme**

After completion of the course, a student should have fundamental understanding of the basic molecular biology of prokaryotic and eukaryotic systems. In addition to an appreciation of the underlying mechanisms and processes, the student is expected to understand the experimental approaches that are used to generate data in the field. A measure of this understanding will be the ability to use the acquired knowledge to explain and interpret experimental observations, and to design appropriately controlled experiments to test hypotheses.

**MDSC 408 Fall semester:** In the Fall semester, you will gain exposure to and experience with the approaches and tools for probing biological phenomena at the molecular level. You will work individually and in pairs on a project using a variety of genetic, biochemical and molecular biological approaches. You will also be assigned a structural bioinformatics assignment that is related to the laboratory work so that you can integrate those concepts with practical lab experience.

The biological system we will be working with, in both the bioinformatics part and the laboratory part, is a fluorescent protein (for example, green fluorescent protein (GFP)). Not only are these proteins interesting in the way organisms use them in nature, they are also widely used as laboratory tools. The system allows us to use many different methodologies and approaches within the time and resource constraints of the course. It has features that include: 1) detailed structural information to facilitate the development of rational site-directed mutagenesis strategies, through which we can easily alter the properties of the protein; 2) an extensive array of well characterized homologues (for the bioinformatics projects); 3) a simple method for production and isolation of recombinant protein, so that we can analyze the altered properties of the proteins. You will need some familiarity with this system to understand the approaches taken, but they will help you develop a fundamental understanding of various concepts and approaches that can be applied to virtually any biological system under study.

**MDSC 408 Winter semester:** The Winter term is an extension of the laboratory work and theory covered in the Fall. While the Fall semester focuses mainly on molecular biology techniques utilized in prokaryotic systems, the Winter term is designed to extend this knowledge to eukaryotic systems. However, similar principles and techniques are applied to both eukaryotic and prokaryotic systems.

The laboratory part of the Winter term will include the discussion of eukaryotic cell culture techniques, types of eukaryotic cell lines, uses for cultured cells, and eukaryotic transfection systems. You will get hands-on experience in maintaining eukaryotic cell lines. You will transfect cells, isolate RNA from cells, synthesize cDNA, and examine changes in the gene expression using reverse transcription PCR (RT-PCR) and quantitative real-time PCR (qRT-PCR). The bioinformatics components will consist of lectures/tutorials and assignments focusing on various sequence analyses and gene expression tools and approaches.

For the final assignment in the Winter semester, you will have to write a proposal that describes a number of experiments to study the effects of a protein (or gene) of your choice in eukaryotic cells. To design these experiments, you will have to use experimental evidence found in the current scientific literature. The purpose of the “letter of intent” is to give a one-page summary highlighting the proposed research you will be addressing with the experiments you are planning. This “letter of intent” will precede your research proposal and help you prepare for the final assignment. It will also help us ensure that you are on the right track with this assignment. The goal of these two assignments and the course is to teach you to integrate new knowledge with the existing knowledge and to design experiments. You will not only be required to explain the concepts covered in the lectures and readings, but to integrate the newly learned concepts into material that you have already learned in other courses or that you have encountered by reading the scientific literature.

### **Global Objectives**

MDSC 408 is designed to give biomedical sciences and bioinformatics students the basic conceptual framework, knowledge and skill set to work and think independently in a medical science or life science research environment. By the end of MDSC 408, students will be able to successfully utilize a number of bioinformatics tools and perform a number of molecular biology techniques, interpret results and troubleshoot when problems arise. The main goal of MDSC 408 is to enhance: 1) the student’s understanding and use of scientific methodology and thought process, 2) the student’s ability to understand and approach problems at the molecular level, 3) the student’s ability to design experiments in a creative manner.

### **Learning Objectives**

By the end of this course, students will be able to:

1. Demonstrate knowledge and understanding of the basic molecular biology techniques and will be able to successfully perform these techniques in a laboratory setting.
2. Apply the gained knowledge to troubleshoot and ultimately correct technically-based problems that arise in the laboratory.
3. Understand experimental design and be able to think through an experiment from beginning to end.

4. Critically evaluate the appropriateness and limitations of using various molecular biology techniques and research designs.
5. Describe why the particular technique/s or research method/s was/were chosen to answer the research question, list the advantages and disadvantages of the chosen method/s and suggest alternative approaches.

Specific Learning Objectives of the Bioinformatics assignments:

1. Perform basic bioinformatics searches and use Swiss-PDB tools to analyze the structure of the proteins.
2. Interpret the results generated by the bioinformatics searches and protein structure modeling and formulate a focused and well-defined hypothesis.
3. Propose methods to test the hypothesis in a framework of several specific aims.
4. Plan cloning and site-directed mutagenesis experiments in silico using various online and open source software tools.
5. Analyse and interpret next generation sequencing data using R and R -studio

Specific Learning Objectives of the Research Proposal assignments:

1. Write a research proposal similar to a common grant format and effectively describe the what, why and how of the experimental approaches.
2. Search current literature efficiently, investigate and evaluate the existing evidence, clearly state the problem to be investigated, and provide rationale for the proposed research.
3. Formulate strong, focused, well-supported and testable research questions/hypothesis and propose methods to test the hypothesis in a framework of several specific aims.
4. Clearly define the criteria for success or failure of proposed methods.
5. Assess feasibility of proposed experiments and research, and supply the necessary information to answer them.

### **Required Textbooks**

*You do not have to buy any textbooks for this course*

### **Recommended Textbooks/Readings**

***(You do not have to buy any of these books, but they are great reference works)***

- *Michael T. Madigan and John M. Martinko. Brock: Biology of Microorganisms. 13th Edition. Pearson Prentice-Hall.*
- *Lizabeth A. Allison. Fundamental Molecular Biology. 2nd edition. John Wiley & Sons.*
- *Gerald Karp. Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons.*

### **A Note regarding readings**

*A list of required readings will be outlined on D2L and links and documents will be made available, where possible. Required readings have been chosen carefully to inform you and enhance the lecture material. **Students are REQUIRED to complete assigned readings BEFORE each lecture.** Instructors will proceed in class on the assumption that students have read completely the*

*assigned readings. Students should be aware that many of the readings they will be assigned may be of an unfamiliar nature and style. Students should allot sufficient time to allow for several reads of the assigned material.*

### Evaluation

The University policy on grading and related matters is described in section F of the 2019-2020 Calendar.

In determining the overall grade in the course, the following weights will be used:

<b>Assignments:</b>		
<b>Description</b>	<b>Due</b>	<b>Proportion of Final Grade</b>
<p><b>Bioinformatics Assignments (Fall Semester):</b></p> <p>This is a series of assignments/exercises that will help you to understand and gain practical experience in working with the bioinformatics tools introduced in class.</p>	<p><b>Various smaller independent assignments throughout both semesters. Adding up to a total of 30%</b></p>	<p><b>30%</b></p>
<p><b>Letter of Intent for the (Winter Semester):</b></p> <p>One-page summary highlighting the proposed research, you will address with your research pro outline.</p>	<p><b>Feb. 28, 2020</b></p>	<p><b>5%</b></p>
<p><b>Research Proposal (Winter Semester):</b></p> <p>For the written final assignment of this course, you will be expected to write a proposal” outlining the experimental approach for the research proposed in the LOI, 5 pages single-spaced not including references or figures. This “proposal” describes the experiments to study the effects of a protein of your choice of eukaryotic cells.</p>	<p><b>Monday Apr. 6, 2020</b></p>	<p><b>15%</b></p>
<b>Exams:</b>		
<p><b>Exam/Quizzes:</b> Examination on all material presented in lectures of both the bioinformatics and the lab sections up to date.</p> <ul style="list-style-type: none"> <li>• 2 quizzes in the Fall (10% each)</li> <li>• 1 Exam in the Winter (10%)</li> </ul>	<p><b>Oct. 10, 2019 Dec. 5, 2019 March 17, 2020</b></p>	<p><b>10% 10% 10%</b></p>

<b>Lab Notebooks:</b>		
Mark includes flow charts due at the beginning of every lab and the notebook that is collected/marked on average every 4 lab sections. Covers pre-lab preparation, participation and lab work documentation. Submitted in its entirety at the end of term.	<b>Dec. 9, 2019 and Apr. 17, 2020</b>	<b>10%</b>
		<b>10%</b>

***There is no final exam for this course.***

***A student's final grade for the course is the sum of the separate assignments. It is not necessary to pass each assignment separately in order to pass the course.***

**A Note regarding Writing Assignments:**

Writing skills are important to academic study in all disciplines. In keeping with the University of Calgary's emphasis on the importance of academic writing in student assignments (section E.2 of 2019-20 Calendar), writing is emphasized, and the grading thereof in determining a student's mark in this course. The Bachelor of Health Sciences values excellence in writing. Competence in writing entails skills in crafting logical, clear, coherent, non-redundant sentences, paragraphs and broader arguments, as well as skills with the mechanics of writing (grammar, spelling, punctuation). The University of Calgary offers a number of instructional services through the Students' Success Centre's Writing Support Services (<http://www.ucalgary.ca/writingsupport/>) for students seeking feedback on assignments or seeking to improve their general writing skills. Students are **strongly encouraged** to take advantage of these programs.

**Grading Scheme:**

<b>Letter Grade</b>	<b>Description</b>	<b>Percentage</b>
<b>A+</b>	Outstanding performance	97-100
<b>A</b>	Excellent performance	90-96
<b>A-</b>	Approaching excellent performance	85-89
<b>B+</b>	Exceeding good performance	80-84
<b>B</b>	Good performance	75-79
<b>B-</b>	Approaching good performance	70-74
<b>C+</b>	Exceeding satisfactory performance	65-69
<b>C</b>	Satisfactory performance	60-64
<b>C-</b>	Approaching satisfactory performance	57-59
<b>D+</b>	Marginal pass	54-56
<b>D</b>	Minimal pass	50-53
<b>F</b>	Did not meet course requirements	0-49

**Missed Components of Term Work:**

Late assignments will not be accepted and will automatically receive a mark of zero. Students who miss a quiz will receive a mark of zero unless the instructor has been previously notified.

There will be NO exceptions to this policy. **NOTE: There will be no make-up exams/quizzes. If you miss an exam for a legit reason the weighting of the exam/quiz will be combined with the next exam/quiz or assignment.**

It is the agreement of the Faculty involved in MDSC 408 that **extensions will NOT be granted** on any assignment or quizzes. The only exceptions to this are those in keeping with the University Calendar (debilitating illness, religious conviction, or severe domestic affliction) that are received in writing and with supporting documentation. Traffic jams and late or full buses are common events in Calgary and are NOT acceptable reasons for late arrivals to class, meetings and examinations. Please note that while absences are permitted for religious reasons, students are responsible for providing advance (14-day) notice and adhering to other guidelines on this matter, as outlined in the University Calendar (<https://www.ucalgary.ca/pubs/calendar/current/e-4.html>).

### **Brightspace by Desire2Learn (D2L)**

Brightspace (by D2L) is located on the University of Calgary server and will be used extensively for communication with students. **It is the student's responsibility to ensure that they receive all posted communications and documents and that they receive emails sent by instructors or fellow students through D2L.** Only your @ucalgary.ca email address may be linked to D2L. Please ensure that you are regularly checking your @ucalgary.ca account.

A laptop, desktop, tablet or mobile device is required for D2L access. If you need help accessing or using D2L, please visit the Desire2Learn resource page for students: <http://elearn.ucalgary.ca/d2l-student/>.

### **Policies Governing the Course:**

#### **Attendance**

Attendance in the laboratories is mandatory and will form part of the lab notebook grade.

#### **Required Materials:**

A lab coat and hard-covered lab notebook (available at the bookstore) are both required for MDSC 408.

#### **Laboratory Safety:**

Students are required to familiarize themselves with the Bachelor of Health Sciences Guidelines for Safety Procedures (posted on the D2L) and follow laboratory safety procedures at all times. Students who do not follow the laboratory safety procedures will be asked to leave the lab.

#### **Preparation for the Lab:**

Laboratory procedures for each lab will be posted in advance on D2L. Should any changes arise after posting of materials, these changes will be communicated to students on the day of the lab or through an updated posting on D2L. Students are expected to print off a copy of the lab manual / protocol and familiarize themselves with the day's work prior to arrival.

At the beginning of every lab, students will be expected to present their lab notebooks with flow charts outlining the experimental approaches for the day. These flow charts will be marked and the lab books will be immediately returned to the student. On the days that the lab books are scheduled to be returned to the students after assessment, the flow charts may be presented on a loose sheet of bond paper, pre-cut to fit into the notebook. After marking, the flow chart must be glued into the notebook.

Students are expected to arrive on time. No flow chart submissions will be accepted more than 10 minutes after start of the lab. Full time lab attendance/participation will also be monitored and forms part of your grade of your lab notebook.

### **General Lab Concerns:**

It is important that students direct all immediate questions and concerns regarding the laboratory portion of the course to their TA or the Laboratory Manager Deirdre Lobb. If they are unable to provide an explanation or answer, then the student should contact Dr. Guido van Marle.

### **Conduct During Lectures**

The classroom should be respected as a safe place to share ideas without judgement - a community in which we can all learn from one another. Students are expected to conduct themselves in a mature and courteous manner during ALL lectures. Students are expected to frame their comments and questions to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic.

**Students are expected to take notes during class and should not rely solely on material supplied by the instructors.**

### **Electronic Devices**

The Bachelor of Health Sciences program aims to create a supportive and respectful learning environment for all students. The use of laptop and mobile devices is acceptable when used in a manner appropriate to the course and classroom activities. However, research studies have found that inappropriate/off-topic use of electronic devices in the classroom negatively affects the learning of both the user and those sitting nearby. Students are to refrain from accessing websites that may be distracting for fellow learners (i.e. personal email, Facebook, YouTube).

Students are responsible for being aware of the University's Internet and email use policy, which can be found at <https://www.ucalgary.ca/policies/files/policies/electronic-communications-policy.pdf>

Cell phones (or similar devices) should **be turned off** (not merely silent) upon entering the classroom. Sending/receiving text messages or leaving the class to take calls is disruptive to the entire class and will not be tolerated unless absolutely necessary. Students who disregard this rule during lectures or tutorials will be asked to leave. These items are not permitted under any circumstance during exams/quizzes, etc.

## Copyright

It is the responsibility of students and professors to ensure that materials they post or distribute to others comply with the Copyright Act and the University's Fair Dealing Guidance for Students ([library.ucalgary.ca/files/library/guidance\\_for\\_students.pdf](http://library.ucalgary.ca/files/library/guidance_for_students.pdf)). Further information for students is available on the Copyright Office web page (<http://library.ucalgary.ca/copyright>)

## A Note Regarding Instructor Intellectual Property

Generally speaking, course materials created by professor(s) (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the professor(s). These materials may **NOT** be reproduced, redistributed or copied without the explicit consent of the professor. **The posting of course materials to third party websites such as note-sharing sites without permission is prohibited.** Sharing of extracts of these course materials with other students enrolled in the course **at the same time** may be allowed under fair dealing.

## Academic Accommodations Based on Disability or Medical Condition

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services; SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit [www.ucalgary.ca/access/](http://www.ucalgary.ca/access/).

## Accommodations on Protected Grounds other than Disability

Students who require an accommodation in relation to their coursework based on a protected ground other than disability, should communicate this need, preferably in writing, to their instructor or to the designated BHSc program contact, Mrs. Jennifer Logan ([jljlogan@ucalgary.ca](mailto:jljlogan@ucalgary.ca)), or to Dr. Ebba Kurz, Associate Dean, Undergraduate Health and Science Education, Cumming School of Medicine. The full policy on Student Accommodations is available at <http://www.ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf>.

## Academic Misconduct

The University of Calgary is committed to the highest standards of academic integrity and honesty. The University of Calgary has created rules to govern all its members regarding the creation of knowledge and the demonstration of knowledge having been learned. For information on academic misconduct and its consequences, please see the University of Calgary Calendar at <http://www.ucalgary.ca/pubs/calendar/current/k.html> Students are expected to be familiar with these standards and to uphold the policies of the University in this respect. Please know that the University and the Cumming School of Medicine take these rules seriously. **All incidences of academic dishonesty in this course, such as cheating and plagiarism, will be reported to the Associate Dean for investigation;** infractions will be noted on the record of a student found to be guilty.

## Recording of Lectures

Audio or video recording of lectures is prohibited except where explicit permission has been received from the instructor.

## **Other Important Information**

### **Freedom of Information and Protection of Privacy Act**

Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary

### **Appeals**

If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section I of the University Calendar. Students must follow the official reappraisal/appeal process and may contact the Student Ombuds' Office (<http://www.ucalgary.ca/ombuds>) for assistance with this and with any other academic concerns, including academic and non-academic misconduct. Students should be aware that concerns about graded term work may only be initiated **within 10 days** of first being notified of the grade. <https://www.ucalgary.ca/pubs/calendar/current/i-2.html>

### **Resources for Support of Student Learning, Success, Safety and Wellness**

Student Success Centre	<a href="http://www.ucalgary.ca/ssc/">http://www.ucalgary.ca/ssc/</a>
Student Wellness Centre	<a href="http://www.ucalgary.ca/wellnesscentre/">http://www.ucalgary.ca/wellnesscentre/</a>
Distress Centre	<a href="http://www.distresscentre.com/">http://www.distresscentre.com/</a>
Library Resources	<a href="http://library.ucalgary.ca">http://library.ucalgary.ca</a>

### **Wellness and Mental Health Resources**

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370 MacEwan Student Centre, <https://www.ucalgary.ca/wellnesscentre/services/mental-health-services>) and the Campus Mental Health Strategy (<http://www.ucalgary.ca/mentalhealth/>).

### **Student Ombuds' Office**

The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit [www.ucalgary.ca/ombuds/](http://www.ucalgary.ca/ombuds/) or email [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca)

### **BHSc Student Faculty Liaison Committee (SFLC)**

The BHSc SFLC, with elected representatives from all majors, serves to raise issues of interest to BHSc students to the program administration, including items pertaining to curriculum, scheduling and events. A list of current representatives can be found on the BHSc website.

## **Student Union (SU) Information**

The SU Vice-President Academic can be reached at (403) 220-3911 or [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca); the SU representatives for the Cumming School of Medicine can be reached at [medrep1@su.ucalgary.ca](mailto:medrep1@su.ucalgary.ca) or [medrep2@su.ucalgary.ca](mailto:medrep2@su.ucalgary.ca).

**Student Success Centre:** The Student Success Centre provides services and programs to ensure students can make the most of their time at the University of Calgary. Our advisors, learning support staff, and writing support staff assist students in enhancing their skills and achieving their academic goals. They provide tailored learning support and advising programs, as well as one-on-one services, free of charge to all undergraduate and graduate students. For more information visit: <https://www.ucalgary.ca/student-services/student-success>

## **Emergency Evacuation/Assembly Points**

As part of the University of Calgary Emergency Evacuation plan, students, faculty, and staff should locate the closest Assembly Point in case of Fire Alarm. Safety signage is posted throughout the campus showing the locations and the possible route to these locations. All students, faculty, and staff are expected to promptly make their way to the nearest Assembly Point if the Fire Alarm is activated. ***The primary assembly point for the Health Sciences Building is the Health Research Innovation Centre Atrium. However, the lab needs to be left through the nearest emergency exit at the East side of the building. You must then walk around the building towards the HRIC atrium area. The alternate assembly point is outside parking lot 6.*** No one is to return into campus facilities until an all clear is given to the warden in charge of the Assembly Area. For more information, see

<http://www.ucalgary.ca/emergencyplan/node/55>

<https://www.ucalgary.ca/emergencyplan/building-evacuation/assembly-points>

## **Safewalk**

Campus security will escort individuals, day or night, anywhere on campus (including McMahon Stadium, Health Sciences Centre, Student Family Housing, the Alberta Children's Hospital and the University LRT station). Call 403-220-5333 or visit <http://www.ucalgary.ca/security/safewalk>. Use any campus phone, emergency phone or the yellow phone located at most parking lot pay booths. Please ensure your personal safety by taking advantage of this service.

**MDSC 408 Fall 2019 schedule**

*(Be aware that the order and schedule may change as lab work is not always predictable)*

Date	Group A	Group B
Thursday September 5	Course introduction  GFP lecture PCR lecture <b>Lab safety</b>	Course introduction  GFP lecture PCR lecture <b>Lab safety</b>
Tuesday September 10	MB 1 PCR, SOE-PCR  Lab 1: pipetting, plates, basic PCR	Lecture 1 BINF BLAST Sequence Databases BINF: Tutorial
Thursday September 12	MB 2 Cloning I: Restriction enzymes  Lab 2: gel and SOE PCR#1	Lecture BINF 2 Alignments PCR Primer design BINF: Tutorial
Tuesday September 17	Lecture 1 BINF BLAST Sequence Databases BINF: Tutorial	MB 1 PCR, SOE-PCR  Lab 1: pipetting, plates, basic PCR
Thursday September 19	Lecture BINF 2 Alignments PCR Primer design BINF: Tutorial	MB 2 Cloning I: Restriction enzymes  Lab 2: gel and SOE PCR#1
Tuesday September 22	MB 3 Cloning II Plasmids  Lab 3: gel, gel extraction and SOE PCR #2	Lecture BINF 3: Benchling  Cloning and SOE PCR Assignment
Thursday September 26	MB 4 Cloning III TA cloning, Gibson Assembly  Lab 4: gel, gel extraction, quantification	Lecture BINF 4: Benchling  Cloning and SOE PCR assignment
Tuesday October 1	Lecture BINF 3 Benchling  Cloning and SOE PCR Assignment	MB 3 Cloning II Plasmids  Lab 3: gel, gel extraction and SOE PCR #2
Thursday October 3	Lecture BINF 4 Cloning and SOE PCR assignment	MB 4 Cloning III TA cloning, Gibson Assembly Lab 4: gel, gel extraction, quantification

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Tuesday October 8	Quiz #1 Q&A 9-10 am	Quiz #1 Q&A 10:30-11:30 am
Thursday October 10	<b>QUIZ #1</b>	<b>QUIZ #1</b>
Tuesday October 15	MB 5 Transformation  Lab 5: restriction digest and ligation	Lecture BINF 5 Protein structure and modeling
Thursday October 17	Lab 6: transformation	BINF tutorial Protein structure and Modeling
Tuesday October 22	Lecture BINF 5 Protein structure and modeling	MB 5 Transformation  Lab 5: restriction digest and ligation
Thursday October 24	BINF tutorial Protein structure and Modeling	Lab 6: transformation
Tuesday October 29	MB 6 Protein expression/purification  Lab 7: Plasmid prep, digest and gel to check insert	BINF Tutorial final Protein structure and Modeling
Thursday October 31	BINF Tutorial final Protein structure and Modeling	MB 6 Protein expression/purification  Lab 7: Plasmid prep, digest and gel to check insert
Tuesday November 5	<b>(no lecture)</b> Lab 8: Protein purification make SDS-PAGE gels	Lecture BINF 6: Alignments and Phylogenetics  Alignments and Phylogenetics and Modeling Tutorial/Exercise
Thursday November 7	MB 7 Protein analysis/gel electrophoresis methods  Lab 9: SDS-PAGE gels, Coomassie stain	Lecture BINF 7 Alignments and Phylogenetics and Modeling Exercise
November 11- November 15	Reading Week (No Class)	Reading Week (No Class)

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Tuesday November 19	MB 8 Reporters again & synthetic biology  Lab 10: analyze gels, spec lysates	Lecture BINF 8 Alignments and Phylogenetics and Modeling Exercise
Thursday November 21	Lecture BINF 6 Alignments and Phylogenetics  Alignments and Phylogenetics and Modeling Tutorial/Exercise	(no lecture) Lab 8: Protein purification make SDS-PAGE gels
Tuesday November 26	Student Union Research Symposium	
Tuesday November 27	Lecture BINF 7 Alignments and Phylogenetics and Modeling Exercise	MB 7 Protein analysis/gel electrophoresis methods  Lab 9: SDS-PAGE gels, Coomassie stain
Tuesday December 3	Lecture BINF 8 Alignments and Phylogenetics and Modeling Exercise  <b>Quiz #2 Q&amp;A</b>	MB 8 Reporters again & synthetic biology  <b>Quiz #2 Q&amp;A</b> Lab 10: analyze gels, spec lysates
Thursday December 5	<b>Quiz #2</b>	<b>Quiz #2</b>

*(Be aware that the order and schedule may change as lab work is not always predictable)*

Date	Group A	Group B		
Tuesday January 14	<b>9 am:</b> <b>Introduction to the winter semester</b>	<b>10 am:</b> <b>Introduction to the winter semester</b>		
Thursday January 16	Lecture 1: <b>Tissue culture and transfection</b>	Bioinformatics 1: <b>Sequencing and Sequence analysis</b>		
Tuesday January 21	Lecture 2: <b>siRNA, CRISPR</b>  Lab 1: <b>BSC demo and plasmid prep</b>	Bioinformatics 2 <b>Sequencing and Sequence analysis</b>		
Thursday January 23	Lab 2: <b>Seed and transfect HEK cells (Half of class comes at 9 am, half at 10:15)</b>	Bioinformatics 3 <b>Sequencing and Sequence analysis</b>		
Tuesday January 28	Lab 3: <b>View transfection, collect and fractionate cells</b>	Bioinformatics 4 <b>Next-Gen Sequencing and analysis</b>		
Thursday January 30	Bioinformatics 1 <b>Sequencing and Sequence analysis</b>	Lecture 1- <b>Tissue culture and transfection</b>		
Tuesday February 4	Bioinformatics 2 <b>Sequencing and Sequence analysis</b>	Lecture 2: <b>siRNA, CRISPR</b>  Lab 1: <b>BSC demo and plasmid prep</b>		
Thursday February 6	Bioinformatics 3 <b>Sequencing and Sequence analysis</b>	Lab 2: <b>Seed and transfect HEK cells (Half of class comes at 9 Am; half at 10:15)</b>		
Tuesday February 11	Bioinformatics 4 <b>Next-Gen Sequencing and analysis</b>	Lab 3: <b>view transfection, collect and fractionate cells</b>		
Thursday February 13	Lecture 3 <b>Viruses as tools</b>  Lab 4: <b>make SDS-PAGE gels</b>	Bioinformatics 5 <b>Next-Gen Sequencing and analysis</b>		
Tuesday February 18	Reading week (No Class)	Reading week (No Class)		
Thursday February 20	Reading week (No Class)	Reading week (No Class)		

*(Be aware that the order and schedule may change as lab work is not always predictable)*

Tuesday February 25	Lab 5: <b>Run SDS-PAGE gels and Western blot</b>	Bioinformatics 6 <b>Next-Gen Sequencing and analysis</b>		
Thursday February 27	Lab 6: <b>Finish Western Blot</b>  Lecture 4 <u>during incubation:</u> <b>Western blots</b>	Bioinformatics 7 <b>Next-Gen Sequencing and analysis</b>		
Tuesday March 3	Bioinformatics 5 <b>Next-Gen Sequencing and analysis</b>	Lecture 3 <b>Viruses as tools</b>  Lab 4: <b>Make SDS-PAGE gels</b>		
Thursday March 5	Bioinformatics 6 <b>Next-Gen Sequencing and analysis</b>	Lab 5: <b>Run SDS-PAGE gels and Western blot</b>		
Tuesday March 10	Bioinformatics 7 <b>Next-Gen Sequencing and analysis</b>	Lab 6: <b>Finish Western Blot</b>  Lecture 4 <u>during incubation:</u> <b>Western blots</b>		
Thursday March 12	10 am: <b>Q&amp;A</b>	9 am: <b>Q&amp;A</b>		
<b>Tuesday March 17</b>	<b>Exam Lectures 1-4</b>	<b>Exam Lectures 1-4</b>		
Thursday March 19	Lab 7: <b>Seed HEK cells for LPS experiment (Half of class comes at 9 am; half at 10:15)</b>	Bioinformatics 7 <b>Gene Expression Analysis and Realtime PCR</b>		
Tuesday March 24	Lecture 5: <b>RNA isolation</b>  Lab 8: <b>Harvest cells, RNA isolation</b>	Bioinformatics 8 <b>Gene Expression Analysis</b>		
Thursday March 26	Bioinformatics 7 <b>Gene Expression Analysis and Realtime PCR</b>	Lab 7: <b>Seed HEK cells for LPS experiment (Half of class comes at 9 am; half at 10:15)</b>		
Tuesday March 31	Bioinformatics 8	Lecture 5:		

*(Be aware that the order and schedule may change as lab work is not always predictable)*

	<b>Gene Expression Analysis</b>	<b>RNA isolation</b> Lab 8: <b>Harvest cells, RNA isolation</b>		
Thursday April 2	Lecture 6: <b>cDNA synthesis</b> Lab 9: <b>cDNA synthesis</b>	Bioinformatics 9 <b>Gene Expression Analysis</b>		
Tuesday April 7	Lab 10: <b>Realtime RTPCR</b>	Bioinformatics 10 <b>Gene Expression Analysis</b>		
Thursday April 9	Bioinformatics 9 <b>Gene Expression Analysis</b>	Lecture 6: <b>cDNA synthesis</b> Lab 9: <b>cDNA synthesis</b>		
Tuesday April 14	Bioinformatics 10 <b>Gene Expression Analysis</b>	Lab 10: <b>Realtime RTPCR</b>		