MEDICAL SCIENCE (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

Dr. Mayi Arcellana-Panlilio, Ph.D.
E-mail: myarcell@ucalgary.ca
Office Hours: By appointment

LABORATORY SUPERVISOR:
Deirdre Lobb
Room 2529A, Health Sciences Centre
Phone: (403) 210-8156
E-mail: 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

Grace Hudson
E-mail: gmhudson@ucalgary.ca

Keith Lau
E-mail: kcklau@ucalgary.ca

Leah Hohman
E-mail: Leah.hohman@ucalgary.ca

Bioinformatics TAs:

Carly Pontifex
Email: cspontif@ucalgary.ca

Wisoo Shin
Email: wshin@ucalgary.ca

Time and Location:

TERM: Fall 2017 and Winter 2018

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) in 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.

Specific Learning Objectives of the Experimental Proposal assignments:

1. Write an experimental outline similar to those in 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 for all course sections 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.2 of the 2018-2019 Calendar.

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

Assignments:		
Description	**Due**	**Proportion of Final Grade**
Bioinformatics Assignments (Fall Semester): 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.	**Various smaller independent assignments throughout both semesters. Adding up to a total of 30%**	**30%**
Lab Summary (Fall Semester): Due at the end of term, this document will summarize the work done during the semester: with background, objectives, main results & discussion, future perspectives, will also include some links to the bioinformatics assignments.	**Dec. 11, 2018**	**10%**
Letter of Intent for the (Winter Semester): One-page summary highlighting the proposed research, you will address with your experimental outline.	**Feb. 28, 2019**	**5%**
Research Proposal (Winter Semester): 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.	**Friday Apr. 5, 2019**	**15%**
Exams:		
Exam/Quizzes: Examination on all material presented in lectures of both the bioinformatics and the lab sections up to date. • 2 quizzes in the Fall (5% each) • 1 Exam in the Winter	**Oct. 11, 2018** **Dec. 6, 2018** **March 12, 2019**	**10%** **10%**
Lab Notebooks:		
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.	**Dec. 1, 2018 and Apr. 12, 2019**	**10%** **10%**

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 2018-19 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:

A+ 97-100%	B+ 80-84%	C+ 65-69%	D+ 54-56%
A 90-96%	B 75-79%	C 60-64%	D 50-53%
A- 85-89%	B- 70-74%	C- 57-59%	F 0-49%

Missed Components of Term Work:

Late assignments will lose 5% per day late past the deadline for all assignments*. Assignments will* ***NOT*** *be accepted more than 72 hours after the posted deadline and students failing to submit any assignment within this time frame will 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.***

It is the agreement of all Faculty and Staff involved in MDSC408 that ***extensions will NOT be granted*** *on any assignment or quizzes. The only exceptions to this are those in keeping with the University Calendar (illness, religious conviction, or domestic affliction) that are received in writing and with supporting documentation. Please be advised that students should notify the instructor before the assignment deadline to discuss.*

Brightspace by Desire2Learn (D2L)

Desire 2 Learn 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 get 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.

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 to 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. If the TA is unable to provide an explanation or answer, then the student should contact Dr. Guido van Marle.

Conduct During Lectures
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 each session 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. Research studies have found that student use of electronic devices (laptops, tablets, etc) in the classroom negatively affects the learning of both the user and those sitting nearby. Inappropriate use of laptops is also disruptive to your fellow classmates and disrespectful to the lecturer. The use of laptops and other electronic note-taking devices is permitted; however, their use in the classroom should be for course-related work/note-taking only. Please do **NOT to surf the web, check email or do other unrelated work**. Students who use their laptops inappropriately or are otherwise disruptive during lectures will be asked to leave.

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.

For (bio)safety reasons, the use of laptops and other electronic devices is NOT permitted in the laboratories.

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). 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
It is the student's responsibility to register with Student Accessibility Services to be eligible for formal academic accommodation in accordance with the Procedure for Accommodations for Students with Disabilities (https://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf). If you are a student who may require academic accommodation and have not registered with Student Accessibility Services, please contact their office at (403) 220-8237; http://www.ucalgary.ca/access/. Students will be provided with all necessary accommodations to ensure equal opportunity to succeed in this course. Please provide the instructor your accommodation letter from Student Accessibility

Services within 14 days after the start of this course so that all needed arrangements for exams and assignments can be made.

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 the designated BHSc program contact, Mrs. Jennifer Logan (jljlogan@ucalgary), or to Dr. Ebba Kurz, Associate Dean, Undergraduate Health and Science Education, Cumming School of Medicine. Students who require an accommodation unrelated to their coursework or the requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Vice-Provost (Student Experience). For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/.

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. These rules are contained principally in Sections J to L of the *University of Calgary Calendar.* Students are expected to be familiar with these standards and to uphold the policies of the University in this respect. The Calendar also stipulates the penalties for violating these rules. 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
This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP); students should identify themselves on written assignments (exams and term work) by their name and ID number on the front page and ID on each subsequent page. Work assigned to you by your course instructor will remain confidential unless otherwise stated before submission. The assignment cannot be returned to anyone else without your expressed permission to the instructor. Grades will be made available on an individual basis and students will not have access to other students' grades without expressed consent. Similarly, any information about yourself that you share with your course instructor will not be given to anyone else without your permission. See http://www.ucalgary.ca/policies/files/policies/privacy-policy-2011.pdf for more information.

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 15 days** of first being notified of the grade.

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

Student Success Centre	http://www.ucalgary.ca/ssc/
Student Wellness Centre	http://www.ucalgary.ca/wellnesscentre/
Distress Centre	http://www.distresscentre.com/
Library Resources	http://library.ucalgary.ca

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/ or email ombuds@ucalgary.ca

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

Emergency Evacuation/Assembly Points
Assembly points for emergencies have been identified across campus. Assembly points are designed to establish a location for information updates from the emergency responders to the evacuees; and from the evacuated population to the emergency responders. 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*. For more information, see the University of Calgary's Emergency Management website:
http://www.ucalgary.ca/emergencyplan/assemblypoints.

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 2018 schedule

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

Date	Group A	Group B
Thursday September 6	Course introduction GFP lecture PCR lecture Lab safety	Course introduction GFP lecture PCR lecture Lab safety
Tuesday September 11	MB 1 PCR, SOE-PCR (1 hr) Lab 1: pipetting, plates, basic PCR	Lecture 1 BINF BLAST Sequence Databases BINF: Tutorial
Thursday September 13	MB 2 Cloning I: Restriction enzymes (1.5hr) Lab 2: gel and SOE PCR#1	Lecture BINF 2 Alignments PCR Primer design BINF: Tutorial
Tuesday September 18	Lecture 1 BINF BLAST Sequence Databases BINF: Tutorial	MB 1 PCR, SOE-PCR (1 hr) Lab 1: pipetting, plates, basic PCR
Thursday September 20	Lecture BINF 2 Alignments PCR Primer design BINF: Tutorial	MB 2 Cloning I: Restriction enzymes (1.5hr) Lab 2: gel and SOE PCR#1
Tuesday September 25	MB 3 Cloning II Plasmids (45 min) Lab 3: gel, gel extraction and SOE PCR #2	Lecture BINF 3: Benchling Cloning and SOE PCR Assignment
Thursday September 27	MB 4 Cloning III TA cloning, Gibson Assembly (1 hr) Lab 4: gel, gel extraction, quantification	Lecture BINF 4: Benchling Cloning and SOE PCR assignment
Tuesday October 2	Lecture BINF 3 Benchling Cloning and SOE PCR Assignment	MB 3 Cloning II Plasmids (45 min) Lab 3: gel, gel extraction and SOE PCR #2
Thursday October 4	Lecture BINF 4 Cloning and SOE PCR assignment	MB 4 Cloning III TA cloning, Gibson Assembly Lab 4: gel, gel extraction, quantification

MDSC 408 Fall 2018 schedule
(Be aware that the order and schedule may change as lab work is not always predictable)

Tuesday October 9	Quiz #1 Q&A 9-10 am	Quiz #1 Q&A 10:30-11:30 am
Thursday October 11	QUIZ #1	QUIZ #1
Tuesday October 16	MB 5 Transformation (1.5 hr) Lab 5: restriction digest and ligation	Lecture BINF 5 Protein structure and modeling
Thursday October 18	Lab 6: transformation (30-45 min)	BINF tutorial Protein structure and Modeling
Tuesday October 23	Lecture BINF 5 Protein structure and modeling	MB 5 Transformation (1.5 hr) Lab 5: restriction digest and ligation
Thursday October 25	BINF tutorial Protein structure and Modeling	Lab 6: transformation (30-45 min)
Tuesday October 30	MB 6 Protein expression/purification (1 hr) Lab 7: Plasmid prep, digest and gel to check insert	BINF Tutorial final Protein structure and Modeling
Thursday November 1	BINF Tutorial final Protein structure and Modeling	MB 6 Protein expression/purification (1 hr) Lab 7: Plasmid prep, digest and gel to check insert
Tuesday November 6	(no lecture) Lab 8: Protein purification make SDS-PAGE gels	Lecture BINF 6: Alignments and Phylogenetics Alignments and Phylogenetics and Modeling Tutorial/Exercise
Thursday November 8	MB 7 Protein analysis/gel electrophoresis methods (while gels run) Lab 9: SDS-PAGE gels, coomassie stain	Lecture BINF 7 Alignments and Phylogenetics and Modeling Exercise

MDSC 408 Fall 2018 schedule
(Be aware that the order and schedule may change as lab work is not always predictable)

November 12-November 17	Reading Week (No Class)	Reading Week (No Class)
Tuesday November 20	MB 8 Reporters again & synthetic biology (1.5 hr) Lab 10: analyze gels, spec lysates	Lecture BINF 8 Alignments and Phylogenetics and Modeling Exercise
Thursday November 22	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 27	Student Union Research	
Tuesday November 29	Lecture BINF 7 Alignments and Phylogenetics and Modeling Exercise	MB 7 Protein analysis/gel electrophoresis methods (while gels run) Lab 9: SDS-PAGE gels, Coomassie stain
Tuesday December 4	Lecture BINF 8 Alignments and Phylogenetics and Modeling Exercise **Quiz #2 Q&A**	MB 8 Reporters again & synthetic biology (1.5 hr) **Quiz #2 Q&A** Lab 10: analyze gels, spec lysates
Thursday December 6	**Quiz #2**	**Quiz #2**

MDSC 408 Winter 2019 schedule

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

Date	Group A	Group B		
Tuesday January 8	***9 am:*** ***Introduction to the winter semester***	***10 am:*** ***Introduction to the winter semester***		
Thursday January 10	Lecture 1: ***Tissue culture and transfection***	Bioinformatics 1: ***Sequencing and Sequence analysis***		
Tuesday January 15	Lecture 2: ***siRNA, CRISPR*** Lab 1: ***BSC demo and plasmid prep***	Bioinformatics 2 ***Sequencing and Sequence analysis***		
Thursday January 17	Lab 2: ***Seed and transfect HEK cells (Half of class comes at 9 am, half at 10:15)***	Bioinformatics 3 ***Sequencing and Sequence analysis***		
Tuesday January 22	Lab 3: ***View transfection, collect and fractionate cells***	Bioinformatics 4 ***Next-Gen Sequencing and analysis***		
Thursday January 24	Bioinformatics 1 ***Sequencing and Sequence analysis***	Lecture 1- ***Tissue culture and transfection***		
Tuesday January 29	Bioinformatics 2 ***Sequencing and Sequence analysis***	Lecture 2: **siRNA, CRISPR** Lab 1: ***BSC demo and plasmid prep***		
Thursday January 31	Bioinformatics 3 ***Sequencing and Sequence analysis***	Lab 2: ***Seed and transfect HEK cells (Half of class comes at 9 Am; half at 10:15)***		
Tuesday February 5	Bioinformatics 4 ***Next-Gen Sequencing and analysis***	Lab 3: **view transfection, collect and fractionate cells**		
Thursday February 7	Lecture 3 **Viruses as tools** Lab 4: **make SDS-PAGE gels**	Bioinformatics 5 ***Next-Gen Sequencing and analysis***		
Tuesday February 12	Lab 5:	Bioinformatics 6		

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

	Run SDS-PAGE gels and Western blot	***Next-Gen Sequencing and analysis***		
Thursday February 14	Lab 6: ***Finish Western Blot*** Lecture 4 *during incubation:* ***Western blots***	Bioinformatics 7 ***Next-Gen Sequencing and analysis***		
Tuesday February 19	Reading week (No Class)	Reading week (No Class)		
Thursday February 21	Reading week (No Class)	Reading week (No Class)		
Tuesday February 26	Bioinformatics 5 ***Next-Gen Sequencing and analysis***	Lecture 3 ***Viruses as tools*** Lab 4: **Make SDS-PAGE gels**		
Thursday Februari 28	Bioinformatics 6 ***Next-Gen Sequencing and analysis***	Lab 5: ***Run SDS-PAGE gels and Western blot***		
Tuesday March 5	Bioinformatics 7 ***Next-Gen Sequencing and analysis***	Lab 6: **Finish Western Blot** Lecture 4 during incubation: **Western blots**		
Thursday March 7	10 am: **Q&A**	9 am: **Q&A**		
Tuesday March 12	**Exam** **Lectures 1-4**	**Exam** **Lectures 1-4**		
Thursday March 14	Lab 7: ***Seed HEK cells for LPS experiment (Half of class comes at 9 am; half at 10:15)***	Bioinformatics 7 ***Gene Expression Analysis and Realtime PCR***		
Tuesday March 19	Lecture 5: ***RNA isolation*** Lab 8: ***Harvest cells, RNA isolation***	Bioinformatics 8 ***Gene Expression Analysis***		
Thursday March 21	Bioinformatics 7 ***Gene Expression Analysis and Realtime PCR***	Lab 7: ***Seed HEK cells for LPS experiment (Half of class comes at 9 am; half at 10:15)***		

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

Tuesday March 26	Bioinformatics 8 ***Gene Expression Analysis***	Lecture 5: ***RNA isolation*** Lab 8: ***Harvest cells, RNA isolation***		
Thursday March 28	Lecture 6: ***cDNA synthesis*** Lab 9: ***cDNA synthesis***	Bioinformatics 9 ***Gene Expression Analysis***		
Tuesday April 2	Lab 10: ***Realtime RTPCR***	Bioinformatics 10 ***Gene Expression Analysis***		
Thursday April 4	Bioinformatics 9 ***Gene Expression Analysis***	Lecture 6: ***cDNA synthesis*** Lab 9: ***cDNA synthesis***		
Tuesday April 9	Bioinformatics 10 ***Gene Expression Analysis***	Lab 10: **Realtime RTPCR**		
Thursday April 11	Lab clean up	Lab clean up		