



## 4LL3 COURSE OUTLINE (JANUARY 2016)

### *Instructors*

Dr. Daniel Yang	HSC 4H25A	yang@mcmaster.ca
Rena M. Cornelius	JHE 374	rcornel@mcmaster.ca

### *Support Staff*

Meagan Heirwegh	HSC 4H45, HSC 1H1-8	biochemistryadvisor@mcmaster.ca
Shari-Ann McCollin	HSC 4H45, HSC 1H1-8	mccolls@mcmaster.ca

### *Teaching Assistants*

Raphael Hanna- Tissue Culture	hannara@mcmaster.ca
Susie Son- Tissue Culture	sons2@mcmaster.ca
Rahul Sadavarte - Bioreactors	sadavarh@mcmaster.ca
Darren Sandejas - Bioreactors	sandejdm@mcmaster.ca
Alysha Spadafora – Biomaterials	spadaa1@mcmaster.ca

### *Labs*

Monday and Tuesday, 1:30-5:30 pm, HSC 1H1-8.

### *Materials & Fees*

Books, Courseware, Notebook, McMaster standard calculator, and Safety Goggles must be **purchased** by each student and brought to each lab. A lab coat will be provided to each student, and is NOT to be removed from the lab. Other lab consumables (timer, sharpies, etc.) will be provided for students as needed (if not returned at the end of the lab the student is responsible for replacing the item).

### *Books*

1. 4LL3 Custom Courseware – Main Campus Store. This is print-on-demand.
2. Laboratory notebook (available for purchase in the Teaching labs at a cost of \$10/ notebook). This is the **ONLY** type of notebook that will be accepted in the lab.

### *Safety Training Requirements*

1. Hospital Fire Safety (core/update)
2. WHMIS (core/update)
3. BSL1, BSL2 training

ALL safety training **MUST** be completed **PRIOR** to the start of labs. This means that students must have completed **ALL** the training and handed in **ALL** quizzes. Students are responsible for providing copies of their safety training documentation to Meagan Heirwegh.

**Course Goals:** One of the goals of this lab course is to introduce you to a number of biochemical techniques, routinely used in industry and academia, in the context of biotechnology and bioengineering. A significant portion of the 4LL course will also be devoted to experimental design/inquiry to develop communication and troubleshooting skills. Equally as important is to immerse you in the collaborative process.

**Course Description:** The course is divided into 3 thematic sections: mammalian cell culture (TC), protein-biomaterial interactions (BM), and bioreactors (BR).

- 😊 TC section - You will passage cells, transfect cells, create a prototype tissue-engineered blood vessel and differentiate mouse embryonic stem cells to osteoblasts.
- 😊 BM section – You will apply fundamental techniques such as SDS-PAGE, Western blotting and total protein assays to elucidate protein adhesion to biomedical materials.
- 😊 BR section – You will be divided up into 2 competing Biotech companies with the common goal of developing a high-throughput protein expression and purification protocol. Students will also be introduced to the basics of bioreactors, including operation of bench scale bioreactors.

You will be divided into four groups that will rotate through the three sections. For clarity purposes, lab dates, as well as group and section information is provided in this courseware.

## **COURSE ASSESSMENT**

Type of Assessment	Total mark (%)
Presentation, Concept Map	<b>10</b>
Tissue Culture Report – pair report	<b>15</b>
Biomaterials Report – individual report	<b>15</b>
Bioreactors (Guided Inquiry)	
Grant Proposal/Lab meeting (10%)	<b>30</b>
Grant Renewal (15%)	
Weekly Order Forms (5%)	
Lab Notebooks	<b>10</b>
Participation and Preparedness/ Quizzes	
Self and Lab Partner Evaluations	<b>10</b>
Peer Evaluations	
In-lab practical	<b>10</b>
<b>TOTAL</b>	<b>100</b>

"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. 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."

### ***Presentation, Concept Map***

Group assignments and guidelines regarding the presentation and concept map will be provided on **Tuesday Jan 5<sup>th</sup>, 2016**. This is an active learning component of the course. Working in the assigned groups, you are expected to prepare a presentation and concept map addressing the specific labs assigned to you. This, combined with your concept map, is worth 10% of your mark. *Note: A hardcopy of your Safety Training Record (screen shot of your training summary on MOSAIC) must be handed in to your assigned TA on Monday Jan 11<sup>th</sup>, 2016.*

## ***Participation/ Preparedness/ Quizzes***

Each week you will be graded on lab performance and participation. Tissue Culture and Biomaterial quizzes will also be given at the beginning of each of the lab sections, to assess your preparedness for the labs in that section. Below is an example of the participation marking sheet the TAs will be using to assess your daily participation in the lab. At the end of each thematic section, you will have input on your overall lab participation mark.

<b>In-lab Participation and Preparedness</b>	Collaboration: <input checked="" type="checkbox"/> Is the student working as part of a pair/team? <input checked="" type="checkbox"/> Is the student engaged in the pair/team project <input checked="" type="checkbox"/> Is the student working efficiently (even during times outside the scheduled lab times)?	Preparedness and awareness. This can include the following: <input checked="" type="checkbox"/> Knowing what to do and why <input checked="" type="checkbox"/> Actively participating in the experiment <input checked="" type="checkbox"/> Using equipment properly and safely <input checked="" type="checkbox"/> Using the lab notebook to record observations and relevant data <input checked="" type="checkbox"/> Obtaining and analyzing results <input checked="" type="checkbox"/> Following the protocol properly	A mark of zero on the day's participation if: No goggles, no notebook, late/inappropriate behavior, lab left untidy, food/drink (or empty containers) found in lab (includes garbage), student was not prepared for work during times outside the scheduled lab times
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The marking scheme is out of 3, where 0 = not satisfactory, 1= satisfactory, 2 = good, 3=excellent.

## ***In-lab Practical Assessment***

You will have an opportunity to demonstrate techniques learned during the term, and give brief answers about the theory behind the biochemical techniques and principles used.

## ***Lab Notebooks***

Guidelines for completing weekly lab notebooks are provided in the courseware. A flowchart for each section is to be completed and included in your Lab Notebook PRIOR to attending the first lab within that section. Recognize that in the experimental design/inquiry portion of the course; your initial flowchart may be modified as the lab work progresses. Prelab questions have also been included for each lab and must be answered in your Lab Notebook PRIOR to coming to the lab. Refer to Lab Notebook Checklist for additional information and requirements regarding your Lab Notebook. Carbon copies of the lab book must be handed in at the end of each day, and random Notebook checks will be performed which will account for 10% of your final grade.

## ***Bioreactors/ Inquiry component***

This component of the course allows you to further develop the necessary skills required for experimental design. As part of a team, you will develop a research proposal aimed at high-throughput expression and purification of a target gene sequence. You will have to develop protocols, timelines and sound experimental approaches which they will present to our panel of reviewers in a lab meeting (verbal communication) as well as a written proposal. Following the execution of your own research design, you will submit a final research renewal designed to explain the results obtained you're your experiments. This component is aimed to exercise both written and verbal communication skills in the context of independent experimental design.

## ***Reports***

Guidelines for the Tissue Culture (Results) Lab Report, the Biomaterials (Formal) Lab Report, the Bioreactors Project Proposal (Grant Application), and the Bioreactors Lab Report (Grant Renewal Application) are provided in the courseware.

# **COURSE EXPECTATIONS**

(Includes missed work, re-grading request policy and lab rules)

**Before we get started we have some expectations we would like to share with you:**

- The labs are extremely important for this course and so, they are mandatory. However, if a lab must be missed due to unforeseen circumstances (such as illness) an MSAF or Approval from the Associate Dean's office must be provided. MSAF is available in the MOSAIC Student Center (in the dropdown menu under Academics). Once proper documentation is provided we will accommodate the missed lab on a case-by-case basis. Additionally, you must complete all requirements of the missed assessment component.
- Missed assessment components also require supporting documentation (MSAF/ APPROVAL by the Associate Dean's office). We will tackle these on a case-by-case basis, but normally we re-distribute the missed mark.
- Try not to be late when handing in your assignments. Late penalties are usually 10%/day unless otherwise specified.
- We have a re-marking request policy. It is available on the A2L content page and on the McMaster Biochemistry website (go to "undergraduate studies", "forms and procedures").
- Lab safety: Our lab is a fun working environment, but it is also a science lab full of chemicals/biologicals and equipment. And so, to maintain a fun and exciting work environment we need to ensure that we are all working together as a team to create a safe work environment. To do this we need to make sure that the following procedures are followed at all times while in the lab:

### GENERAL LAB RULES

- Please be alert at all times while in the lab. The lab is full of people: be prepared and always let the people around you know when you are working with dangerous substances/equipment. Also, be very cautious when moving around in the lab space. Notify your MENTOR/Meagan/Rena immediately if you observe any unsafe practices.
- No food or drink in the lab. This means that you may NOT bring food or drink into the lab and you may NOT throw out empty food/drink containers in the lab garbage.
- No laptops/cell phones/etc. are allowed during the lab.
- You cannot work alone in the laboratory (a MENTOR /Meagan/Rena must be present at all times).
- Labcoats will be provided. If you forget your goggles you will be asked to purchase them from the bookstore prior to attending the labs. We do not provide you with goggles.
- You will have a storage area for your book bags and jackets that is not in the actual wet-lab space. You must leave your pencil case, hats, etc. in this area. You may NOT eat or drink in this area!!! In addition, you cannot store any food or drink in this area. All water bottles/drinks and any food MUST be stored in your bag so that they are not visible to anyone standing in this area.
- Please do NOT wear your lab coat outside the lab space. The hallway is NOT an appropriate place for you to put on your lab coat.
- Wash your hands with soap and water in the designated hand washing sink after performing all experiments and prior to leaving the lab.
- Please make sure that you do not walk around the lab and distract other students during the lab period.
- Please make sure that you take notes during the lab safety walk through and you know the location of safety features in the lab. Please make sure that you know the proper procedures in case of emergencies.
- All chemicals/biologicals in the laboratory are to be considered dangerous. Avoid handling chemicals without gloves. Always read the MSDS prior to handling any chemicals/biologicals and follow the proper safe handling instructions. Do not taste, or smell any chemicals/biologicals. Never return unused chemicals to their original container.
- Report any accident (spill, breakage, etc.), injury (cut, burn, etc.) or broken equipment to your TA immediately. Do not panic. If you or your lab partner is hurt, immediately (and loudly) yell out your TA's name to get their attention. Do not panic.
- Dispose of all chemical waste properly. Never mix chemicals in sink drains. Check with your TA for disposal of chemicals and solutions. Never dump any chemicals down the hand washing sink.
- Please maintain good housekeeping practices. Work areas should be kept clean and tidy at all times.

- Perform only those experiments authorized by your TA. Carefully follow all instructions, both written and oral. Unauthorized experiments are not allowed. If you do not understand a direction or part of a procedure, **ASK YOUR TA BEFORE PROCEEDING WITH THE ACTIVITY.**
- You may not eat or drink anything from the lab. You may not take anything home from the lab (test tubes, gels, reagents, Petri dishes, pipette, etc.) or bring any outside experiments into the lab.
- Please do not touch any of the equipment without proper training and supervision by your TA.

**Please bring your purchased lab notebook, courseware, safety goggles, and calculator to ALL labs. Also, during the labs please ensure that you wear close-toed shoes (no flip flops!), and long hair is tied back. Please be prepared for the day's lab and you have completed the notebook requirements, the safety requirements and are alert throughout the lab. Please conduct yourself with professionalism and respect when in the lab environment.**

With the information provided, you should be able to:

- ☺ Work reasonably independently. However, not all the methods will be spelled out in detail every time: SDS-PAGE, for instance, is the same in the first section as in the second section. It is your responsibility to work out the exact steps to take and adapt the protocols where needed. TAs can be used as a resource.
- ☺ Complete the lab. Because of the nature of molecular biology, the lab sessions will not all be the same length. Organization and preparedness on your part will greatly improve both the time in the lab and the final results.
- ☺ Maintain a lab notebook. All procedural changes and results must be recorded in pen in the Lab Notebook on the date they are acquired. In addition, there will be some times when you will have to come to the lab outside the scheduled lab periods. These sessions will be short and the scheduling will be flexible.

### ***Use of Avenue2Learn (A2L)***

This course uses A2L to post the course outline, lab results and other notices. 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.

### ***Academic Integrity***

“Our assumption is that every student attending this course is doing so to discover the world of Biotechnology. Any student that would like to ignore our assumption should visit the Academic Integrity Policy at McMaster University for information on academic dishonesty (<http://www.mcmaster.ca/academicintegrity/>)”.

### ***Student Accessibility***

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail [sas@mcmaster.ca](mailto:sas@mcmaster.ca). For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

### ***Collaboration Policy***

This course focuses on teamwork and collaboration. This is because science and engineering both rely heavily on teamwork and sharing of ideas. Care must be taken to ensure equal distribution of work ethic and acknowledgement of individual ideas and creativity whenever collaborating with anyone. This is not only respectful but also fair. Additionally, it allows for a free-flowing, creative environment where individual ideas are proposed and acknowledged properly. This always gives rise to individual and team empowerment, productivity, optimism and a sense of contribution. Only wonderful things can happen when you acknowledge each other's contributions.

Collaboration between your peers is wildly encouraged (in and out of class time). Care must be taken when undertaking these collaborations. When entering in peer collaborations, make sure you come prepared. Attempt the assignment on your own, write down possible answers and highlight sticking points (points you do not understand). You can then collaborate with your peers to discuss these sticking points. Following your collaboration, you can finish your assignment on your own while reflecting on your discussions. At the bottom of each assignment page, acknowledge all your collaborations (peer names and how you collaborated with them). Likewise, if you consulted a lab report from a previous year (which is totally acceptable, by the way), please acknowledge the report author. Please do not misrepresent others' work as your own. If you did not collaborate with anyone you can simply state that your work was conducted on your own. When collaborating on any group project, each group member must write down their name on each page/slide they contributed to. At the end of each group project, each member must write out (briefly) how they contributed to each project and reflect on their group collaboration experience.

## LAB SCHEDULE

Date	Group I	Group II	Group III	Group IV
Tuesday January 5, 2016	Introductions, Lab Safety, Section Assignments/Dialogue (MDCL3020)			
Monday January 11, 2016	Presentations (MDCL 3020)			
Tuesday January 12, 2016	Presentations (MDCL 2232)			
Monday January 18, 2016	TC-1 Lab	BM-1 Lab	BR-1 Lab	BR-1 Lab
Tuesday January 19, 2016	TC-2 Lab	BM-2 Lab	BR-2 Lab	BR-2 Lab
Monday January 25, 2016	TC-3 Lab	BM-3 Lab	BR-3 Lab	BR-3 Lab
Tuesday January 26, 2016	TC-4 Lab	BM-4 Lab	BR-4 Lab	BR-4 Lab
Monday February 1, 2016	TC-5 Lab	BM-5 Lab	BR-5 Lab	BR-5 Lab
Tuesday February 2, 2016	BM-1 Lab	TC-1 Lab	BR-6 Lab	BR-6 Lab
Monday February 8, 2016	BM-2 Lab	TC-2 Lab	BR-7 Lab	BR-7 Lab
Tuesday February 9, 2016	BM-3 Lab	TC-3 Lab	BR-8 Lab	BR-8 Lab
<b>Monday February 15, 2016</b>	<b>READING WEEK</b>			
<b>Tuesday February 16, 2016</b>	<b>READING WEEK</b>			
Monday February 22, 2016	BM-4 Lab	TC-4 Lab	BR-9 Lab	BR-9 Lab
Tuesday February 23, 2016	BM-5 Lab	TC-5 Lab	BR-10 Lab	BR-10 Lab
Monday February 29, 2016	BR-1 Lab	BR-1 Lab	TC-1 Lab	BM-1 Lab
Tuesday March 1, 2016	BR-2 Lab	BR-2 Lab	TC-2 Lab	BM-2 Lab
Monday March 7, 2016	BR-3 Lab	BR-3 Lab	TC-3 Lab	BM-3 Lab
Tuesday March 8, 2016	BR-4 Lab	BR-4 Lab	TC-4 Lab	BM-4 Lab
Monday March 14, 2016	BR-5 Lab	BR-5 Lab	TC-5 Lab	BM-5 Lab
Tuesday March 15, 2016	BR-6 Lab	BR-6 Lab	BM-1 Lab	TC-1 Lab
Monday March 21, 2016	BR-7 Lab	BR-7 Lab	BM-2 Lab	TC-2 Lab
Tuesday March 22, 2016	BR-8 Lab	BR-8 Lab	BM-3 Lab	TC-3 Lab
Monday March 28, 2016	BR-9 Lab	BR-9 Lab	BM-4 Lab	TC-4 Lab
Tuesday March 29, 2016	BR-10 Lab	BR-10 Lab	BM-5 Lab	TC-5 Lab
Monday April 4, 2016	<b>LAB PRACTICAL</b>			
Tuesday April 5, 2016	<b>LAB PRACTICAL</b>			
<b>Reading Week</b>	Monday February 15, 2016 – Saturday February 20, 2016			
<b>Good Friday</b>	Friday March 25, 2016			

## DUE DATES

Assessment Type	Group I	Group II	Group III	Group IV
Presentations (MDCM 3020)	Mon Jan 11, 2016	Mon Jan 11, 2016	Mon Jan 11, 2016	Mon Jan 11, 2016
Presentations (MDCL 2232)	Tues Jan 12, 2016	Tues Jan 12, 2016	Tues Jan 12, 2016	Tues Jan 12, 2016
Concept Map	Mon Jan 18, 2016 1:30pm	Mon Jan 18, 2016 1:30pm	Mon Jan 18, 2016 1:30pm	Mon Jan 18, 2016 1:30pm
Lab Notebooks	All students are required to hand in their lab notes (carbon copy) at the end of <u>each</u> lab day			
Tissue Culture Lab Report and Evaluations	Fri Feb 12, 2016 5:00pm	Fri Mar 4, 2016 5:00pm	Fri Mar 25, 2016 5:00pm	Fri Apr 8, 2016 5:00pm
Biomaterials Lab Report and Evaluations	Fri Mar 4, 2016 5:00pm	Fri Feb 12, 2016 5:00pm	Fri Apr 8, 2016 5:00pm	Fri Mar 25, 2016 5:00pm
Bioreactors Project Proposal	Mon Mar 7, 2016 1:30pm	Mon Mar 7, 2016 1:30pm	Mon Jan 25, 2016 1:30pm	Mon Jan 25, 2016 1:30pm
Bioreactors Weekly Order Form	Bioreactor teams submit their weekly order form to their TA <u>EVERY THURSDAY</u> , by 1:00pm			
Bioreactors Grant Renewal Application and Evaluations	Fri Apr 8, 2016 5:00pm	Fri Apr 8, 2016 5:00pm	Fri Mar 4, 2016 5:00pm	Fri Mar 4, 2016 5:00pm
Lab Practical	Mon Apr 4, Tues Apr 5 – Schedule to be posted			

During the 4LL3 2016 term, you will be expected to work individually, in pairs, and in small groups. Evaluations will be carried out as follows:

4LL3 Presentation	Pair
Concept Map – A2L dropbox submission	Group and Pair
Lab Participation/Preparedness/Quizzes – in lab	Individual
Lab Notebooks (Carbon Copy) – in lab submission	Individual
Tissue Culture Lab Report– A2L dropbox submission	Pair
Biomaterials Lab Report– A2L dropbox submission	Individual
Bioreactors Project Proposal– A2L dropbox submission	Group
Bioreactors Grant Renewal – A2L dropbox submission	Individual
Lab Practical – in lab	Individual