Welcome to Biochemistry 2L06!!

This course aims to introduce students to basic Biochemistry techniques in the context of a research project. The “lab component” is designed to allow students an interactive role in such powerful techniques as Recombinant DNA cloning, protein over-expression systems and protein purification. Students will also gain an appreciation for the application of these techniques in many relevant fields; from drug design to cytogenetics. Lectures will be given throughout the course to strengthen the understanding behind these powerful techniques. Students will also gain ample experience in report writing and presentations. The” communication-skills” component aims to introduce students to the process of “scientific research” from a Biochemistry Researcher’s point of view. Students will research the work currently implemented by a McMaster University Biochemistry Researcher. The component includes an interview with the researcher and a journal club presentation in which students will discuss a journal article published by their researcher.

Instructor:

Dr. Felicia Vulcu (vulcuf@mcmaster.ca)

Office → HSC-1H6. My door is always open for questions but I do prefer setting up an appointment by email. Please note, students are NOT allowed in the teaching labs after 1:00pm UNLESS the time corresponds to their scheduled course. This is due to the fact that other labs are in progress.

Undergraduate Laboratory Staff:

Adam Pyke –Instructional Assistant

Lecture: every Monday 9:30-11:20am in CNH-B107

Labs: Every Wed/Thurs/Fri, 1:30-5:30pm in HSC 1H1-8 (Biochemistry Undergraduate Teaching Labs)

ALL LECTURES AND LABS ARE MANDATORY!

Each student MUST bring the courseware to ALL lectures. Each student MUST bring their purchased lab notebook, courseware, lab coat, safety goggles, and calculator to ALL labs. Also, during the labs please ensure that you wear close-toed shoes (no flip flops, slippers!), and long hair is tied back. It is expected that EACH student is fully prepared for the day’s lab. EACH student must have completed the notebook requirements, the safety requirements and EACH student MUST be aware and alert during the lab. Each student is to conduct themselves with professionalism and respect when in the lab environment. No horseplay of any kind is tolerated!
SAFETY TRAINING REQUIREMENTS:

1. Fire Safety (core) – Monday September 13, 9:30am in CNH-B107

2. WHMIS (core) – Thursday September 16, 1:30pm in HSC-1A5 OR Friday September 17, 1:30pm in HSC-1A5 (students can also attend core WHMIS on September 7th in MDCL 3020)

3. BSL1 training – online (http://www.fhs.mcmaster.ca/safetyoffice/training.html)

ALL safety training MUST be completed PRIOR to the start of labs (the week of September 20-24, 2010). This means that students must have completed ALL the training and handed in ALL quizzes to the safety office (HSC 1J11).

Session: This is a full year course, running from early September to early April.

There will be no lecture on Thanksgiving Day, Monday, Oct. 11, 2010 or on Monday, Feb. 21, 2011 because of Reading Week.

There will be no labs on Feb. 21-25, 2011 because of Reading Week.

Materials & Fees:

Books, Courseware, Notebook, McMaster standard calculator, Safety Goggles, Lab coat must be purchased by each student and brought to each lab. Lab consumables (timer, sharpies, etc.) will be provided for you in the lab (if not returned at the end of the lab the student is responsible for replacing the item).

Books:
1. Custom Courseware
2. “Biochemistry Laboratory: Modern Theory and Techniques” by Rodney Boyer
3. 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.

Policy on Attendance, Missed Work, and Late Penalties:

- Attendance to ALL laboratories is MANDATORY. One missed lab (without APPROVAL by the Associate Dean’s office) will constitute a zero on the quiz, lab notebook, lab participation AND is counted as a warning. Two missed labs (without APPROVAL by the Associate Dean’s office) will constitute a ZERO in the course.
- Attendance to ALL lectures is MANDATORY.
- Attendance will be taken in class with quizzes which must be completed in class and handed in at the END of class.
- Missed quizzes/reports/presentations/labs or tests will be graded as ZERO.
- Late lab notebook copies will NOT be accepted.
• Unless otherwise specified, a late lab report will be docked 10% per day, and will not be accepted after five days.
• Any report/quiz/notebook/lab report handed in without a name or ID number will receive an automatic ZERO.
• It is the responsibility of the student to back-up all their computer work. **No allowances** will be given to students for turning in late reports **due to computer problems**.
• Any area in the lab left untidy will result in a mark of ZERO on the day’s participation sheet for the students (individual, pairs or entire group).
• Only an **APPROVAL** from the Associate Dean’s office will suffice to provide some exemption from the above regulations.
• **Students may NOT switch lab sections!!!**

**Use of Avenue2Learn (http://avenue.mcmaster.ca):**

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.

**Main Course Objectives:**

1. Obtain experience in basic Biochemistry techniques in the context of a research project.
2. Gain insights into research currently being conducted in the Department of Biochemistry.
3. Gain experience in valuable skills such as communication (written and verbal) and group-work.

**Specific Course Objectives:**

In this course students will be introduced to the basics of both technical and transferrable skills required to become a successful Biochemist. The”communication-skills” component includes:
Communication skills, both verbal and written
Interview skills
Interactive skills, with group members and researchers

The “lab component” includes:
- Technical skills like PCR, SDS-PAGE, agarose-gel electrophoresis, cloning, protein purification, enzyme assays, protein concentration determination (Bradford and Lowry assays), etc.
- Notebook and report-writing skills (an extension of communication skills)
- Presentation skills (relaying scientific knowledge)
- Troubleshooting (part of your research project)

**Overall Description of 2 Terms:**
*The entire course is designed to give students insights into Biochemistry from a research perspective. The lab component will allow students hands-on experience in designing and executing a research project. Students will acquire the knowledge required to fully***
understand basic techniques - the order of techniques and their limitations - while experiencing their very own research project in which their goal is to PCR-amplify a gene (which they will have to identify) and characterize the protein product derived from this gene compared to a commercially bought protein product. Students will have to obtain a detailed understanding of Recombinant DNA cloning, protein purification and bacterial expression systems in order to successfully execute their research project. The” communication-skills” component gives students a taste of research from a “researcher’s” perspective. Students will gain understanding of what it takes to conduct research in the Department of Biochemistry at McMaster University. Verbal and written communication skills are at the forefront of this component and students will have a chance to exercise both these skills in multiple ways. The weekly lectures will provide students with the basics required to complete these tasks, ask questions, interact with group members, interact with Teaching Assistants and listen to guest lecturers.

The entire course is divided into the “DNA component” in term 1 and the “protein component” in term 2.

**Course Assessment:**

<table>
<thead>
<tr>
<th>Assessment (for the entire year!)</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overall Lab Notebooks (Terms 1 and 2)</td>
<td></td>
</tr>
<tr>
<td>This mark can be broken down into 3 components:</td>
<td></td>
</tr>
<tr>
<td>1. Lab notebook = 10%</td>
<td>27</td>
</tr>
<tr>
<td>2. Prelabs = 10% (please note, this includes <strong>ONLY</strong> a select</td>
<td></td>
</tr>
<tr>
<td>number of prelabs which will be specified in your courseware)</td>
<td></td>
</tr>
<tr>
<td>3. Drylabs = 7%</td>
<td></td>
</tr>
<tr>
<td>2. Lab Participation (Terms 1 and 2: can include other worksheets,</td>
<td>10</td>
</tr>
<tr>
<td>interviews, etc.)</td>
<td></td>
</tr>
<tr>
<td>3. Quizzes (Terms 1 and 2)</td>
<td>8</td>
</tr>
<tr>
<td>4. Mini Lab Write-ups (Term 2)</td>
<td>13</td>
</tr>
<tr>
<td>5. Final Report (Term 2)</td>
<td>25</td>
</tr>
<tr>
<td>6. PBL Presentation – Research Project (Term 2)</td>
<td>7</td>
</tr>
<tr>
<td>7. “The 1st Annual Journal Club Series” (Term 1)</td>
<td>5</td>
</tr>
<tr>
<td>8. Project Proposal</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Notebook/Participation marks include all other workshops/worksheets not described above
### Assessment (per term)

<table>
<thead>
<tr>
<th>Description</th>
<th>TERM 1</th>
<th>TERM 2</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Notebooks</td>
<td>5%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>Prelabs</td>
<td>7%</td>
<td>3%</td>
<td>10%</td>
</tr>
<tr>
<td>Drylabs</td>
<td>7%</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td>Lab Participation</td>
<td>5%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>4%</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>Mini Lab Write-ups</td>
<td>0%</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Final Report</td>
<td>0%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>PBL Presentation</td>
<td>0%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Journal Club Presentation</td>
<td>5%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Project Proposal</td>
<td>5%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>38%</td>
<td>62%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Academic Integrity:** You are expected to exhibit honesty and use ethical behavior 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 behavior 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](#) at McMaster University. The following illustrates only three forms of academic dishonesty: Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained. Improper collaboration in group work. Copying or using unauthorized aids in tests and examinations.

1. **Lab Notebooks (10%, T1+T2)** – A series of lab notebooks written by the student each week. Lab notebooks must be designed as specified below. Carbon copies of the labs will be handed in at the END of each lab section. At the BEGINNING of each lab section, TA’s will check that ALL sections of the lab notebook are complete.

### How to Maintain a Laboratory Notebook

*You MUST bring your lab notebook and custom courseware to each lab:*

*Each lab needs to contain the following sections in your notebook:*

1. **A Table of Contents** – please reserve a few pages at the beginning of the notebook for a table of contents. This should include the lab number, page number and a short (1-2 sentences) description of each lab.
2. **Your name/ TA name/ Lab Day/ Date** – on ALL pages!
3. **Lab number and title of lab**
4. **Purpose of lab** → Please write 1-3 paragraphs stating – in YOUR own words – the main purpose of the lab. This should include the purpose of this lab within the main research project.
5. **Flowchart highlighting the MAIN steps of the lab** (not too much detail please and do NOT copy the procedure from your courseware).
6. **Safety** → a list of major safety concerns. If working with dangerous chemicals please look up the MSDS for that chemical and write out all possible dangers related to exposure to the chemicals, safe handling procedures and procedures in case of spills or other exposure to
chemicals. MSDS sheets can be found online OR they can be found in the teaching labs.

REFERENCES!!!!

7. **Prelab Exercises** which include what is found in this courseware as well as any other exercises distributed during the lecture component of this course. This component is worth 10% of your final mark!

8. **Calculations** that must be completed PRIOR to coming to the lab – you must read the lab thoroughly and figure out which calculations you need before coming to the lab!!! This may not always be explicitly stated. This means that you need to read and understand the lab!!!

9. **Charts/tables** that must be drawn in the notebook PRIOR to coming to the lab and which are used to collect data during the lab.

10. During the lab, each student must record their procedures. If the procedure follows the manual exactly simply state: “As described in the manual, page ...., steps 1-...). If the procedure is different from the manual please write down the difference (include information on which step of the procedure was conducted differently). ALWAYS WRITE OUT ALL OBSERVATIONS (INCLUDING COLOR/VISCOSITY CHANGES, ETC.).

11. Figures/Figure captions and Discussion might be required for specific labs. This information will be relayed in the lecture/lab component.

12. MUST be legible or you will receive a mark of ZERO!

13. REFERENCES! You must have proper references for all your lab notebooks. Please embed references throughout your notebook (numerical) and include a reference list at the end of EACH lab notebook section. I prefer primary references (that implies research articles).

You will NEED to go to the following RefWorks site:

Start an account and learn how to use RefWorks. Build your reference list. You will export your reference list (bibliography) using the ACS (American Chemical Society) citation style. This is a requirement for this course!

Carbon copies of the labs will be handed in at the end of class! Discussion sections (when applicable) will be handed in at the beginning of next lab.

**Safety:** please ensure that when working in the lab you designate an area for your courseware/notebook and you do NOT work over this area so as to avoid spillage on your books. If you do spill on your books, please let your TA know and clean up your books appropriately (depending on the spill).

Please note, at the beginning of each lab your TA will ensure that each student has completed the sections described above. This is part of your participation mark!

The first 2 wet-lab notebooks will not count towards your notebook mark (this refers to term 1, lab 1 and lab 3). The labs (1 and 3) will be marked by the TAs so as to provide feedback on your TA’s marking style and expectations. However, the prelabs for these labs DO count towards your prelab mark.
2. Prelabs (10%, T1+T2) – A series of questions/research questions to be completed PRIOR to the start of certain labs. Students must hand in their prelab questions on a SEPARATE SHEET OF PAPER with their name, TA name, lab date and room number. The prelabs that count for the 10% mark (along with the breakdown of this mark) are as follows:

<table>
<thead>
<tr>
<th>Lab</th>
<th>% (of the total 10% prelab mark)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab 1</td>
<td>1</td>
</tr>
<tr>
<td>Lab 2</td>
<td>1</td>
</tr>
<tr>
<td>Lab 3</td>
<td>1</td>
</tr>
<tr>
<td>Lab 4</td>
<td>1</td>
</tr>
<tr>
<td>Lab 6</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Term 1 = 7%

Total Term 1 + Term 2 = 7% + 3% = 10%

3. Drylabs (7%, T1) – A series of labs that do not require wet-lab work but are conducted in the Biochemistry Teaching Labs. These labs will occur in Term 1 and are designed to give students ample insight into the detail-oriented world of recombinant DNA technology. Students are required to bring their labcoat, goggles, notebook, courseware, etc. to the drylabs. The breakdown of the 7% mark is as follows:

<table>
<thead>
<tr>
<th>Term 1</th>
<th>% (of 7% drylab mark)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drylab 1</td>
<td>3</td>
</tr>
<tr>
<td>Drylab 2</td>
<td>1</td>
</tr>
<tr>
<td>Drylab 3</td>
<td>3</td>
</tr>
</tbody>
</table>

4. Lab Participation (10%, T1+T2) - each lab day students will be assessed by their TA (with some input from the instructor/Adam) to ensure all students are prepared for the day’s lab. The assessment sheet outline follows:

1. Lab Coat (must wear at all times; a mark of 0 on entire sheet if no lab coat)
2. Safety goggles (must wear at all times; a mark of 0 on entire sheet if no goggles)
3. Lab notebook (does the student have it? a mark of 0 on entire sheet if no notebook)
4. Lab Notebook (has the student completed all the sections required for the notebook? /1)
5. Preparedness (does the student know what they are doing for the day’s lab? are they letting their partner do everything? etc.) /2
6. Preparedness (does the student use the equipment properly? is the student collaborating with their partner? /2)
7. Attendance (was the student late for the lab? Has the student attended the required number of hours? A mark of 0 on entire sheet if they are late OR if they leave early)
8. Inappropriate behavior (is the student horse-playing in the lab? Is the student talking back to the TA? is the student not following instructions?, etc.) a mark of 0 on entire sheet if inappropriate behavior is seen
9. Overall performance and general comments /2

*The marking scheme is out of 2, where 0 = not satisfactory, 1 = satisfactory, 2 = good/excellent. The TA/instructor/Adam reserves the right to distribute a mark of ZERO for the entire day’s participation depending on the student’s (groups’) behavior in the lab (as judged by instructor/TA/Adam).

5. Quizzes (8%, T1+T2) - the quizzes will be distributed at random times during the term (in LECTURE and in LAB) and will encompass a number of areas from general concepts, to calculations, to flowcharts that test the students’ ability to understand their research project.
**6. Mini Lab Write-ups (13%, T2)** – a series of 3 lab write ups which will develop writing skills in various scientific areas (from writing introductions, to writing materials and methods, to making publication-quality figure captions.

**7. Final Report (25%, T2)** – students will write a final report to describe their research project, purpose of the research project, current data in the field, the data obtained, troubleshooting, future directions, etc.

**8. PBL Presentation (7%, T2)** – As a group, students will present the 2L06 research project. Each group will emphasize 1 specific lab (technique) that they will have to describe in detail. This lab (technique) is part of the research project and will be conducted in term 2. The lab (technique) will be assigned to each group by the instructor. The students are to explain the background of this lab in detail, the purpose of this step in the overall context of the course, the advantages and disadvantages of this technique and elaborate on other techniques that can be implemented in place of the technique in question. Also, all the students are to introduce the function of their protein along with the purpose of this study.

**9. Journal Club Presentation (5%, T1)** - Your task is to present an in-depth, innovative and informative critical paper review that serves to introduce your readers (fellow class mates, researchers, etc.) to your researcher’s research, the impact of their research to their field of study and the future goals of their lab, by critically analyzing one of their most recent papers.

**10. Project Proposal (5%, T1)** – Your task is to further expand on your current research. You need to submit a project proposal highlighting the purpose of your study (Term 1 and Term 2) and data acquired to date.