Instructor: Kathryn Vanya Ewart, Ph.D., vewart@dal.ca, Tupper 9-S1

Laboratory teaching assistants:
- Xingjian Chang
- Ronie Haro
- Spencer Jones

Lectures and labs: Fridays, 2:35-5:25 p.m.
- Lectures: Room 4117, Dentistry Building
- Laboratory sessions: Room 8-J1, Tupper Building
- Poster presentations: Tupper Building Link

Course Description
An introduction to key laboratory methods in biochemistry is presented, along with relevant theory and applications. Topics include liquid handling, protein chemistry, small molecule assays, data analysis and data management. Current context and emerging methodologies are introduced by guest speakers.

Note
This course does not count as a Biochemistry & Molecular Biology credit towards any degree with a Major or Honours in Biochemistry & Molecular Biology, but it can be counted towards a Minor in Biochemistry & Molecular Biology.

Course Prerequisites
CHEM 2401.03 and CHEM 2402.03; BIOC 2300.03; BIOL 2020.03 and BIOL 2030.03; or instructor's permission.

Course Objectives/Learning Outcomes
This course was developed in order to provide an opportunity for B.Sc. Medical Sciences students to prepare for laboratory research opportunities in clinical, academic or industrial labs. The course is also appropriate for students in other undergraduate programs, provided they have completed the prerequisites or have prior instructor's approval. The content was developed in
consultation with the B.Sc. Medical Sciences program leaders, other Dalhousie researchers and local life sciences companies.

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

1. Understand the importance of responsible biomedical research in the laboratory setting.
2. Understand the importance of laboratory procedures and the roles of laboratory team members, both in discovery-based and production-based research.
3. Be aware of ethical considerations in discovery, production and clinical research.
4. Be acquainted with new developments in laboratory methods, laboratory technology and automation.
5. Skillfully and safely handle standard laboratory equipment.
6. Perform basic analyses on protein concentration data obtained in the laboratory and become aware of further analytical steps for different kinds of data.
7. Study the effects of physical and chemical treatments on protein stability and recognize the importance of good sample handling in the laboratory.
8. Separate proteins using affinity chromatography and understand the principles of molecular separation methods.
9. Analyze proteins based on size with subsequent blotting and mass spectrometry and understand some principles and applications of proteomics as an “omics” example.
10. Perform a routine analysis of a health-relevant small molecule analyte and understand key concepts in clinical chemistry.
11. Record research data in a notebook and be aware of the information value and legal value of good laboratory records.

Course Materials

There is no textbook required for this course. Study materials will be provided in the lab manual (purchase details below) and on Brightspace.
Course Assessment
Evaluation will include the following components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight (% of final mark)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion of WHMIS training</td>
<td>2.5%</td>
<td>On or before September 27\textsuperscript{th}, 2019</td>
</tr>
<tr>
<td>Laboratory exercise flow charts outlining the work planned</td>
<td>2.5%</td>
<td>Must be submitted at the start of each of the five practical laboratory sessions</td>
</tr>
<tr>
<td>Laboratory notebook entries completed in proper format and according to directions provided on the five in-lab practical laboratory exercises</td>
<td>20%</td>
<td>Must be submitted by 5:00 p.m. on the Tuesday following each of the five practical laboratory sessions</td>
</tr>
<tr>
<td>Midterm exam</td>
<td>20%</td>
<td>October 18\textsuperscript{th}, 2019</td>
</tr>
<tr>
<td>Questions on guest presentations</td>
<td>4%</td>
<td>Must be submitted at the end of each guest lecture</td>
</tr>
<tr>
<td>Service learning poster presentation on a current or emerging biomedical laboratory method and its application (a list of techniques will be provided from which to choose)</td>
<td>16%</td>
<td>Event on November 29\textsuperscript{th}, 2019, with poster file submission due one week before event</td>
</tr>
<tr>
<td>Final exam</td>
<td>35%</td>
<td>TBD, within the regular final exam schedule</td>
</tr>
</tbody>
</table>

Other course requirements
Attendance at the 5 laboratory sessions is mandatory.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

<table>
<thead>
<tr>
<th>Numerical Grade</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+ (90-100)</td>
<td>A+ (80-84)</td>
</tr>
<tr>
<td>A (85-89)</td>
<td>A (75-84)</td>
</tr>
<tr>
<td>A- (80-84)</td>
<td>A- (70-72)</td>
</tr>
<tr>
<td>B+ (77-79)</td>
<td>B (73-76)</td>
</tr>
<tr>
<td>B (73-76)</td>
<td>B (69-72)</td>
</tr>
<tr>
<td>B- (70-72)</td>
<td>B- (65-69)</td>
</tr>
<tr>
<td>C+ (65-69)</td>
<td>C+ (60-64)</td>
</tr>
<tr>
<td>C (60-64)</td>
<td>C (55-59)</td>
</tr>
<tr>
<td>C- (55-59)</td>
<td>C- (50-54)</td>
</tr>
<tr>
<td>D (50-54)</td>
<td>D (45-54)</td>
</tr>
<tr>
<td>F (&lt;50)</td>
<td>F (&lt;40)</td>
</tr>
</tbody>
</table>
Specific course policies

- **Laboratory exercise flow charts** must be ready for instructor or TA viewing at the beginning of the laboratory session. They are not submitted, but are assessed directly, and remain with the student during the laboratory session for convenience. No mark will be given for flow charts that are not ready for evaluation at the beginning of lab sessions.

- **Lab notebooks** will be docked a mark per day if submitted late (-1 mark after 5:00 p.m. on Tuesday, -2 marks after 5:00 p.m. on Wednesday and so on).

- Although the students will work in pairs for the laboratory exercises, their flow charts and notebooks will be marked individually.

- **The mid-term and final exams** will cover the specific techniques used, principles upon which they are based and current developments relating to those techniques. They will consist of multiple choice and short answer questions. The purpose of each exam is to assess the students’ knowledge in a fair and objective manner.

- **There will be no makeup midterm exam.** If a student misses the midterm for excused medical or personal reasons, the result of the final test and exam will be prorated to be worth 55% of the total course grade instead of 35%. If necessary, a makeup final exam will be held after the end of the course. Students who need to write a makeup exam for medical/personal reasons are expected to be available during this period.

- Students will work in pairs on the poster presentations and they will be given a single mark per pair. There will be no individual marks given for this assignment.

- If a student is unable to complete an exam or poster presentation at the scheduled time due to illness or other valid reasons, the student must submit a Student Declaration of Absence form (available on Brightspace) either electronically or in printed form within 3 days of the event. **Travel for holidays is not an exceptional circumstance and will not be accommodated.**

- There will be no food allowed in the classroom or laboratory sessions during this course. If a student has food, it must be stored in a backpack or other suitable case. Water and covered beverages may be brought into classrooms, but not into laboratory areas.

- Since highly concentrated protein solutions are used in the laboratory exercises, these exercises have been designed to avoid the use of Health Canada’s top twelve priority allergens (see https://www.canada.ca/en/health-canada/services/food-nutrition/food-
safety/food-allergies-intolerances/food-allergies.html#wb-cont) as test proteins. If a student is allergic to another component used in the laboratory exercises (and can show this with appropriate medical documentation), appropriate accommodation will be made.

Course content

This course will focus on five technical topics and each will be covered in a 3-hour lecture session and a 3-hour laboratory session.

- **Topic 1**: Good lab procedures and liquid handling
- **Topic 2**: Preservation and stability of biomolecules
- **Topic 3**: Purification of biomolecules
- **Topic 4**: Analysis and identification of biomolecules
- **Topic 5**: Measurement of clinically relevant analytes

Research safety, research ethics and responsibilities in research will also be introduced in the course.

The final class on Nov. 29th will be a service learning poster event. Students in this course will present posters focusing on new laboratory technologies and methods. The event will be open to Dalhousie University students, faculty and staff who wish to learn about new developments in laboratory techniques that could be useful in their work.

In all, the course will involve several components.

1. **Lecture sessions**: There will be six 3-hour classroom sessions, held from 2:30 – 5:30 p.m. on Fridays. Generally, sessions will provide an introduction to a laboratory research topic, including fundamentals, methodology and current and future applications. Expert guest speakers will be involved in some of the lecture sessions.

2. **Laboratory sessions**: There will be five 3-hour laboratory sessions held from 2:30 – 5:30 p.m. on Fridays, alternating weeks with the lectures (see schedule below). Each lab exercise will highlight an important aspect of research methodology corresponding to the associated lecture. The laboratory manual will be available for $20* at the end of the first lecture session on Friday, September 6th and then in room 9-S1, Tupper Building, on Monday, September 9th between 3:00 and 6:00 p.m. and on Tuesday, September 10th between 3:00 and 6:00 p.m. (Please be sure to read the laboratory exercises and prepare flow charts as required before coming to the lab sessions.)
   *The fee covers printing costs.

3. **Student presentation session**: There will be a student poster session on November 29th.
4. **Student involvement:** In addition to lecture and laboratory attendance, this course requires substantial independent study of the material in order to develop broadly based and in-depth knowledge of the methods and concepts covered. Teamwork will be essential in the laboratory sessions and preparation of the posters. The latter will also require careful planning and time management.

5. **Communication and assistance:** Open-door office hours will be scheduled. In addition, office appointments for extra help can be set up at other times and assistance will be available directly via email. Assistance will be available until 12:00 midnight the evening before exams or before assignments are due. However, it is best to plan ahead and seek assistance early.

**Course schedule and locations**

**Sept. 6th:** Dentistry Building, 4117  
Introduction to course, **Lecture 1** on good lab procedures and liquid handling

**Sept. 13th:** Tupper Medical Building, 8-J1  
**Lab 1** - Liquid handling and data generation

**Sept. 20th:** Dentistry Building, 4117  
**Lecture 2** on preservation and stability of biomolecules  
**Guest speaker:** Dr. Marianne Stanford (Immunovaccine Inc.) will visit to give a presentation and have a Q&A session.

**Sept. 27th:** Tupper Medical Building, 8-J1  
**Lab 2** - Denaturation and stabilization of proteins

**Oct. 4th:** Dentistry Building, 4117  
**Lecture 3** on purification of biomolecules  
**Guest speaker:** Ms. Victoria Miller (Laboratory Manager, Dalhousie University, with experience in leading clinical assay development) will visit to give a presentation and have a Q&A session.

**Oct. 11th:** Tupper Medical Building, 8-J1  
**Lab 3** - Separation of proteins by chromatography

**Oct. 18th:** Dentistry Building, 4117  
Mid-term exam (1 hour) followed by short break and **Lecture 4**, on identification and analysis of biomolecules

**Oct. 25th:** Tupper Medical Building, 8-J1  
**Lab 4** - Analysis of proteins by SDS-PAGE and MS
Nov 1st: Dentistry Building, 4117
Guest speaker: Dr. Alejandro Cohen (Scientific Director, Proteomics and Metabolomics Core Facility, Dalhousie University) will visit to provide an overview of proteomics and share the MS analytical results from lab 4.
This will be followed by Lecture 5, on measurement of clinically relevant analytes.

Nov. 8th: Tupper Medical Building, 8-J1
Lab 5 - Measurement of analytes

Nov. 15th: NO CLASSES – STUDY BREAK

Nov. 22th: Dentistry Building, 4117
Guest speaker: Dr. Paul Gratzer (Dalhousie University and DeCell Technologies Inc.) will visit to give a presentation and have a Q&A session. This session will also include Lecture 6, on research ethics and a review of the poster presentation plan for the following week.

Nov. 29th: Tupper Building Link
Students’ poster presentations (service learning)

December exam period (date and time TBA): Final exam (3 hours)
University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity
At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility
The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct
Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can’t be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Diversity and Inclusion – Culture of Respect
Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness
Statement: http://www.dal.ca/cultureofrespect.html
Recognition of Mi’kmaq Territory
Dalhousie University would like to acknowledge that the University is on Traditional Mi’kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).
Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html

University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Missed or Late Academic Requirements due to Student Absence (policy)
https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Student Resources and Support

Advising
General Advising https://www.dal.ca/campus_life/academic-support/advising.html
Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html
Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html
Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html
International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports
Library: https://libraries.dal.ca/
Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html
Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html
Copyright Office: https://libraries.dal.ca/services/copyright-office.html
Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html
Student Advocacy: https://dsu.ca/dsas

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html
Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html
Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html
Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html