

Chemistry of Living Systems Syllabus

Department of Chemistry

CHEM3601 Winter 2024



Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours	Booking Link
Alexander Baker, PhD Principal instructor	Alexander.Baker@dal.ca	Tuesday or Thursday 9:30 – 10:30 am Chemistry 531 Or by appointment	Link
You are welcome to request an appointment for a specific time outside the regular office hours by e-mail (CHEM3601 in the subject line).			
Reinaldo Moya Barrios, PhD Lab Instructor	RBarrios@dal.ca	Monday and Tuesdays 12:00-1:00 pm Chemistry 1053 Or by appointment (email to arrange)	

Course Description

The chemical principles governing a wide variety of biological processes are discussed. Structure and mechanism are emphasized in explanations and predictions of the behavior of organic compounds in nature. Specific topics include proteins, activation of carboxyl groups, peptide synthesis and biosynthesis, enzyme catalysis, coenzymes and prochirality. Overall, the material presented will provide an overview of the relationship between chemistry and all living organisms. This course is equivalent to 3 credit hours.

Course Prerequisites: CHEM 2402

Student Resources

Lecture slides: lecture notes will be available on Brightspace <https://dal.brightspace.com>.

Concept resources will be posted on Brightspace throughout the term:

- Practice problems
- Additional links to relevant readings and resources

Additional tips for success:

Attend class. The more classes you attend the better you will do! Engaging in content through discussion in class and with students will enhance your understanding of class content.

Take good notes. Taking your own notes by writing will help you to learn.

Study. Keep up with the material. It is critical to stay up with the material. Practice Problem sets and answers will be posted to Brightspace. Working through the practice problems provided is a significant way to enhance knowledge-based learning in CHEM3601.

Class quizzes. Do the quizzes independently and thoroughly using the quizzes to learn the class material is a great way to enhance your class outcome. Practice Organic chemistry. Do the problem sets as soon as possible after they appear on Brightspace and do NOT look at the answers until the problem set is complete.

Office hours: Alexander Baker are Tuesday and Thursday from 9:30 – 10:30 am in Chem 531. Bookings for 15-minute meetings are available to booked 7 days in advance and up to 12 h before the desired appointment. To request an appointment for a specific time outside the regular office hours e-mail Alexander.Baker@dal.ca (CHEM3601 in the subject line).

Course Structure

Course Delivery

This course is delivered in-person with lectures and laboratories.

Lectures

Lectures are Monday, Wednesday, and Friday from 12:35 to 1:25 pm in **LSC-common area room C332**. Lecture material including lecture notes, and relevant readings will be uploaded to Brightspace.

Laboratories

Laboratories are Monday and Tuesday from 1:35 – 5:25 pm in **Chemistry podium 118 (Inorganic laboratory)** depending on your section.

Course Materials

Brightspace: All class material including, class communication via announcements, lecture notes, practice problems and laboratory announcements and information, will be posted to Brightspace.

The material that will be on the CHEM3601 midterm tests and the final examination will be covered in the PowerPoint slides that will be available on Brightspace.

Textbook: There is no required textbook for this course. The following textbooks have been used in CHEM 2401/2402 and BIOC 2300 respectively and provide a helpful overview of several topics and additional practice problems.

- 1) **Organic chemistry**, Paula Yurkanis Bruice, 8th edition; Prentice Hall, 2016
- 2) **Biochemistry**, Emine Ercikan Abali; Susan D. Cline; David S. Franklin; Susan Viselli; Denise R. Ferrier, 8th edition, Philadelphia: Wolters Kluwer, 2022

Independent work: All graded work in CHEM3601 (class and laboratory reports) must be done independently by each student enrolled in the class. The online CHEM3601 quizzes have been developed to help enhance student's mastery of the course contents. Working on these quizzes independently and thoroughly will help with student's overall success in CHEM3601. In-person assessments will be 'closed book' with no aids allowed. Independent work is required for the fulfillment of CHEM3601.

Student work that is not independently done *will receive a mark of 0* on the submitted material.

Review the course Brightspace and any other online learning resources. Access to Brightspace is required to complete the quiz assessments.

Assessments

All quizzes and midterm tests will count towards the final grade in CHEM3601. There will be a three-hour synchronous in-person final examination to be scheduled via the registrar during the regular exam period. There will also be four (4) laboratory reports to complete during the term.

A minimum grade of 40% must be obtained on the final examination in CHEM3601 to pass the class.

Any grade less than 40% on the final examination in CHEM3601 will automatically result in a grade of "F" in CHEM3601.

A minimum grade of 10/20 is required in the laboratory portion of CHEM3601 to pass the class.

Course Assessment:	Weight
Online Quizzes	15%
Midterm 1 In-person	15%
Midterm 2 In-person	15%
Final examination In-person	35%
Laboratory	20%
Total:	100%

Online Quizzes (3% each 5 total) - 15%

Quizzes will be held throughout the term, each worth 3% of the final grade. The tentative dates are posted on Brightspace but are subject to change. Each topic will have an associated quiz that must be done within the time allowed for the quiz. Each quiz will be accessible for a minimum of 6 days. Each quiz is graded independently for a total quiz grade of 15%. Online quizzes are open book, and all class resources can be used. Online quizzes must be done independently. Topics that will be covered include:

- Amino acids and peptides
- Proteins and carboxyl activation
- Enzymes and active sites
- Coenzymes and enzyme kinetics
- Biomolecules beyond proteins

Midterms (15% each 2 total) - 30%

Two midterm evaluations both scheduled to run during class will be hand-written. The tentative date for Midterm 1 is February 7th and Midterm 2 is March 6th. Both scheduled dates for Midterms 1 and 2 are subject to change. In the case of an unexpected disruption such as a power outage or fire alarm that impacts a scheduled Midterm, an announcement will be made on Brightspace to reschedule the Midterm to the next lecture period.

Final exam – 35%

There will be a three-hour in-person cumulative exam final examination to be scheduled via the registrar during the regular exam period.

Laboratory – 20%

Each student will complete four (4) lab reports during the term. In addition, marks will be awarded for prelab preparation, lab organization and skills to reflect an assessment of your prelab preparedness and general laboratory techniques.

Conversion of numerical grades to final letter grades follows the

[Dalhousie Grade Scale](#)

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

There will be no make-up quizzes and all online quizzes must be completed. If a quiz is missed the student will receive a grade of “0%” for that quiz unless other arrangements have been made between the student and the Instructor.

There will be no make-up exams for either midterm 1 or midterm 2. If midterm 1 is missed due to illness or other personal issues the grade weight (percent) of the midterm test will be added to the final examination. At least one midterm test must be written to write the final examination in CHEM3601. As such, if midterm 1 is missed, midterm 2 must be written and the mark counted towards your final mark in CHEM3601. If both midterms are missed the student will receive a grade of “INC” for CHEM3601 unless other arrangements have been made between the student and the Instructor. Please be sure to attend classes scheduled for the midterm tests.

A Student Absence Declaration (SDA) must be submitted for any missed midterm test. Please upload a completed SDA to Brightspace if a midterm cannot be written.

There will be four (4) laboratory experiments in CHEM3601. The total laboratory grade will make up 20% of the final grade in CHEM3601 and will be spread out over the in-person labs. More information on the lab grading scheme can be found in the laboratory manual.

All experiments must be completed in order to pass the lab component. Marks will be deducted for late reports (penalty is -10% for each day of the delay). If you are ill or experiencing an extreme personal emergency at the time of a lab, email Dr. Moya-Barrios to inform him of the situation. In addition, **you must complete a Student Declaration of Absence**, as per the regulations in the Dalhousie University Calendar.

The Final Examination (time and place) will be scheduled by the Registrar. The final examination will be an in-person, three (3) hour exam and will cover the entire course. The final examination may include some questions from the laboratory portion of the course. A student may write a make-up final examination if the final examination was missed with a justifiable, documented reason. An SDA must be complete within 24 hours of the final examination date and time. The date and time of the make-up examination will be decided a few days after the CHEM3601 final examination has been written and will be at the end of the regular examination period. **Only one make-up final Examination will be offered in CHEM3601** (see the [University Regulations, Calendar](#)). **The student is responsible for contacting the Instructor at Alexander.Baker@dal.ca to arrange the make-up final examination in CHEM3601. The Instructor will not contact the student.** Failure to contact the Instructor prior to the final examination date or within 24 hours

after the final examination and to provide appropriate documentation for the missed final examination will result in a grade of 'INC' for CHEM3601. CHEM3601 has no supplementary examination. A student who does not write the final examination will receive a grade of 'INC' for CHEM3601. The University policy is that final examinations are not returned to students. The final examination in CHEM3601 can only be reviewed in-person.

The first in-person laboratory for the Monday section is on January 15th, 1:30-5:30 pm. Tuesday section will start on January 16th, 1:30-5:30 pm. The complete schedule of experiments can be found in the CHEM3601 Laboratory Manual and on the Brightspace site.

Safety is very important. Failure to comply with safety instructions given by the Instructor and/or a Teaching Assistant will result in expulsion from the laboratory. Approved eye protection and a cotton laboratory coat are required at all times within the laboratory. All pertinent safety training (WHMIS 2015, and the Dalhousie Laboratory Safety Course), must be completed before the deadlines listed in the CHEM 3601 Laboratory Manual. If you have recently completed CHEM 2401/2402, you have likely taken the WHMIS course, in that case simply upload the proof of completion to the CHEM 3601 Brightspace site by the due date.

The CHEM3601 Laboratory Manual for this academic year is required, as is a hardcover laboratory notebook. Laboratory work is an integral part of this class. Laboratory activities will in-person and in groups of two (2) or three (3) students. The lab work will help you to learn and appreciate practical techniques and will help you to understand lecture topics. In the in-person labs, students will learn or expand their laboratory skill set through the preparation, purification and characterization of biomolecule derivatives using organic reactions, and explore kinetics learned in the lecture component. Although they are strongly related, the lectures and the laboratories have a different emphasis in what they teach. Nevertheless, material in the laboratories will complement the information from the lectures, and vice-versa. The midterm tests and final examination may include questions from the laboratory part of the course.

The detailed running of the laboratories will be handled by Dr. Reinaldo Moya Barrios who will be assisted by Teaching Assistants (TAs).

The laboratory sessions are an essential part of this course. The details of assessment in the laboratory will be given in the laboratory and can be found in the CHEM3601 Laboratory Manual, Winter 2024. In order to pass CHEM3601, the laboratory part must be passed. Therefore, attendance at the laboratory sessions is mandatory. Students should arrive at the laboratory on time and well-prepared. Questions concerning how the laboratories are run and about the material covered in the laboratory should be directed to the Laboratory Instructor.

In-Person Laboratory:

- Laboratory experiments and reports will relate to the lecture material during the Winter 2024 term.
- In-person labs will be conducted in the Chemistry podium 118 (Inorganic Laboratory, Chemistry Building), once per week, for three hours.
- Even though the lab work is conducted in groups, students must submit individual lab reports.
- Students will do these in-person labs in the lab sections they registered for. A detailed schedule for these in-person labs will be posted on Brightspace and can be found in the CHEM 3601 Laboratory Manual.
- The in-person work will be divided into four (4) laboratories spanning the semester.
- Each lab will have a lab report. More details on lab reports can be found in the CHEM 3601 Laboratory Manual and on the class Brightspace site.
- There shall be NO eating in the laboratory.

Materials Required for In-Person Labs:

- CHEM3601 Laboratory Manual, Winter 2024 (required) – available from the Dalhousie bookstore.
- Hardcover laboratory notebook (required)
- Safety glasses are mandatory (including students with prescription glasses) for CHEM3601 labs; must have CSA-Z94-3 or ANSI Z87 rating.
- Lab Coats 100% cotton and long-sleeved are mandatory for CHEM3601 labs. Your lab coat must fit properly and must reach to near the knees. Sleeves must not be rolled up.

2015 Workplace Hazardous Materials Information System (WHMIS) training: all students must complete the 2015 WHMIS training (provided through the Dalhousie College of Continuing Education) and upload proof of completion. Students who completed the module in the 2023 Fall term or within the last three (3) years do not need to redo it this term, they simply will upload proof of completion to Brightspace. The deadline for this requirement is January 14th, 2024, 11:59 pm.

Laboratory Safety course: all third and fourth-year students are required to complete the Laboratory Safety course developed by the Environmental Health and Safety Office and also provided through the Dalhousie College of Continuing Education. Just like for the WHMIS course, you will receive a Letter of Completion (as a PDF document) via email from the College of Continuing Education (cceehs@dal.ca). After you have received your Letter of Completion please upload the PDF document to the Brightspace site. The due date to complete the Laboratory Safety course (and upload proof of completion) is January 21, 2024, 11:59 pm. If you completed this course during this academic year, simply upload the proof of completion by the due date.

Course Policies

Announcements

Class notifications and updates will be posted to the announcements on Brightspace.

Delayed Content

In the case of a weather-related closure, internet or power interruptions, online content may be delayed.

Cancelled Classes

In the case of a weather-related closure of the University, a DalAlert email will be sent to all students, faculty and staff. Other information can be found at www.dal.ca/storm.html. In the event that CHEM3601 needs to be cancelled, notification will be sent by email and a notice will be placed on the classroom door.

Lecture Recording

Lectures may be recorded according to the [Class Recording Policy](https://www.dal.ca/dept/university_secretariat/policies/academic.html) found at https://www.dal.ca/dept/university_secretariat/policies/academic.html by the instructor for personal academic use but *may be accessible* to students enrolled in CHEM3601 if arrangements have been made between the student and the Instructor. These recordings may also be used for future courses of the same subject in subsequent years. Students who have received prior written permission from the instructor or with an approved Accommodation Plan in place can also make a recording for personal use. If you do not want to be recorded, alternate means of participating and asking questions are available (e.g. by email, during office hours, or passing written notes with questions).

Student Health and Wellness

As a Dalhousie student, you have access to a wide range of resources to support your health and wellbeing. Students looking to access physical or mental health and wellness services at Dalhousie in Halifax can go to the Student Health & Wellness Centre in the LeMarchant Building. In Truro, physical or mental health and wellness services are available at Health Services in the Dairy Building (Student Success Centre). The teams include: registered nurses, doctors, counsellors and a social worker. Taking care of your health is important. Visit dal.ca/studenthealth to learn more and book an appointment today.

Students also have access to a variety of online mental health resources, including telephone/texting counselling and workshops/training programs. Learn more and access these resources at dal.ca/mentalhealth.

Teaching Team: Department of Chemistry

The CHEM3601 teaching team is here to support you and your mental health – please reach out to us. If we can't help directly, we can refer you to Dalhousie's expert resources.

Course Policies related to Academic Integrity

All assessments in CHEM3601 are to be performed independently. While the laboratory component of CHEM3601 will involve group activities, the reports should be prepared independently. Dalhousie's approved originality checking software will be used to detect plagiarism in CHEM3601.

Expectations around generative AI and large language models (e.g., ChatGPT)

Feel free to use AI-driven tools to assist you in learning but remember that the objective is for you to acquire the competencies and outcomes in CHEM3601.

While you may use tools for learning, specifically lab reports in CHEM3601 will disallow the use of AI-driven tools to assert that you have attained course learning outcomes.

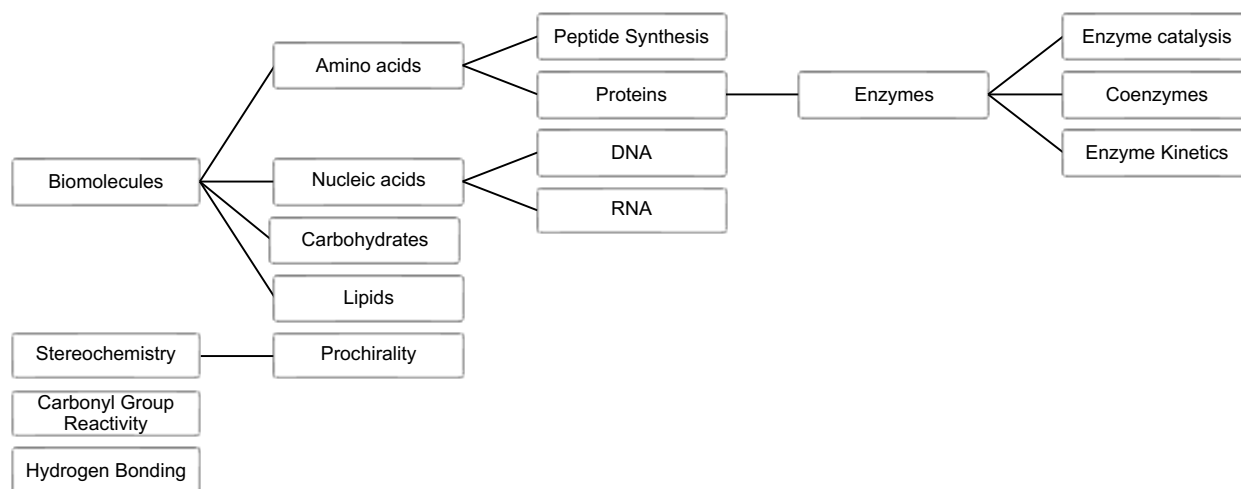
This is because a student must be able to analyze, assess and produce work unassisted by AI technology.

Learning Objectives

- To be familiar with molecules found in living systems in terms of their structure and stereochemistry
- Understand reactions used by or used to study living systems
- Recognize that chemistry is fundamental to essential biological processes to support living systems
- Experience performing experiments complimentary to study the chemistry of living systems

Course Content

Structure, including stereochemistry, and mechanism (i.e., arrow-pushing) are emphasized in discussions of the behaviour of organic compounds in nature (living systems). The structures of small and large molecules will be described along with the reactivity of small molecules in living systems. The catalytic role of enzymes and coenzymes as catalysts will be examined from a mechanistic perspective. Overall, the material covered will illustrate the fundamental relationship between chemistry and the existence of all living organisms. A strong understanding of organic chemistry at the second-year level is needed for the successful outcome of CHEM3601. A willingness to study and engage in the material will be strong assets for the completion of CHEM3601.

Concept map:


University Policies and Statements

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 at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all 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. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or

experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>).

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

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 (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.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. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.