Syllabus CHEM/ENCH 323: Biological Chemistry

Winter term 2026
On Campus (3 credits)
108 Total Learning Hours
Pre-requisites: CHEM 223 or CHEM 282

Course instructors

Dr Avena Ross (she/her)
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Lectures:
[redacted]

Lectures will use a combination of PowerPoint slides and handwritten notes, The last week of the course will be dedicated to group presentations on timely Biological Chemistry topics, the exact format will be determined closer to the time.

Classroom accessibility:
[redacted] has accessible seating
does not have accessible seating

Course Description:
Introduction to the chemical basis of biological systems and biomolecules, protein structure and synthesis, enzyme catalysis, nucleic acids (DNA, RNA), carbohydrates, membranes, cell signalling, biosynthetic and metabolic pathways.

Course Content Outline
1. Introduction to Biomolecules
2. Proteins: Properties of Amino Acids- nomenclature, stereochemistry, acid/base, Properties of Peptide Bonds- formation, geometry, nomenclature, sequence analysis, Polypeptide Structures- conformations, secondary structure, interactions between secondary structure
3. Enzymes: Enzyme Kinetics- Michaelis Menten kinetics, parameters, Enzyme Inhibition- competitive, uncompetitive, mixed, Mechanisms of Catalysis- General acid/base, covalent, co-factors/pyridoxal phosphate

4. Carbohydrates: Structure and Properties of Carbohydrates – nomenclature, mutarotation, anomeric effect, conformation of monosaccharides, oligosaccharides and glycosidic bonds, glycosyltransferases and biosynthesis.
5. Nucleic Acids: Structure and Synthesis of DNA- DNA replication, selection, catalysis, error correction, ligation; Structure and Transcription of RNA- RNA polymerase, regulation, Translation of RNA- ribosome, ^{t}RNA, ^{t}RNA synthetases, initiation, recognition, bond formation, termination
6. Peptide and Carbohydrate Synthesis and Biosynthesis: Selected examples of the following topics may be discussed: solution and solid supported synthesis – peptides and carbohydrates; general strategies for making glycosidic bonds and orthogonal protecting group strategies; RiPPs (Ribosomally synthesized and post-translationally modified peptides); NRPs (non-ribosomal peptides); Chemo-enzymatic synthesis.
7. Student Presentations on Biological Chemistry Topics: A project where groups of 4 students will research a Biological Chemistry topic and then give a presentation for 15 mins to teach the rest of the class about this topic

Course Learning Outcomes
At the end of CHEM 323, students will be able to…

1. Identify important features of peptide, protein, nucleic acid and carbohydrate structures. Recommend and illustrate structure determination techniques.
2. Propose reaction mechanisms for enzyme-catalyzed reactions that produce amino acid, nucleic acid and carbohydrate based biomolecules.
3. Demonstrate the interconnections between molecule classes in the central dogma of molecular biology by designing nucleic acid sequences based on protein sequences and vice versa
4. Collaborate with a small group of peers to deliver a presentation, on a topic of biological importance, which extends and applies course concepts

Approximate Content Timeline

Week	Content Covered	Assessments (Tentative)
Week 1	Introduction to Biological Chemistry and Molecules	
Week 2	Proteins	
Week 3	Proteins	Assignment 1 Posted
Week 4	Proteins	
Week 5	Enzyme Kinetics and mechanisms	Assignment 1 Due
Week 6	Enzyme mechanisms	Mid Term [redacted]
Reading Week		
Week 7	Carbohydrates	
Week 8	Carbohydrates	
Week 9	Nucleic Acids	Assignment 2 Posted

Week 10	Nucleic Acids	
Week 11	Peptide and Carbohydrate Synthesis and Biosynthesis	
Week 12	Group Presentations	Assignment 2 Due

Important University Dates
Please visit the Faculty of Arts and Sciences Sessional Dates website for all academic deadlines.

Office Hours: Will be offered by appointment, please email us, your instructors to book a time. If you have questions about the course material, please either ask us directly after class or book an office hour time. Please reserve email questions for personal or private matters. Please note there will be dedicated office hours scheduled before the midterm and final exams, dates/times and locations to be posted in OnQ

Welcome Message
Welcome to CHEM/ENCH 323, we are your instructors, Dr. Ross and Dr. Capicciotti. We are experts in the areas of biomolecule biosynthesis (Dr. Ross) and Glyco-chemistry/biology (Dr. Capicciotti). We are really looking forward to meeting you all and sharing our love of biological chemistry and all the cool things it can be applied to. We hope that after taking this course you will feel confident discussing the basic structure and function of biomolecules.

Equity, Diversity and Inclusivity Statement
You belong here! Equity in an educational institution is achieved when all members of our society have fair and equal opportunity to participate in and enjoy the benefits of an education, including the opportunity to experience success and human dignity while developing the skills, knowledge and attitudes necessary to contribute as leaders and citizens in society. We are committed to counteracting discrimination in this institution and developing a climate of educational equity that recognizes and respects the equal dignity and worth of all who seek to participate in the life, work and mission of the University.

Land Acknowledgement
To begin, let us acknowledge that Queen's is situated on traditional and unceded Anishinaabe and Haudenosaunee territory. We are grateful to be able to be live, learn and play on these lands. – Four Directions Indigenous Student Centre, Queen's University

Expectations for instructors:
As your instructors we will enthusiastically guide you through the course material, we will post lecture material to OnQ in advance of classes and provide updates to the class using announcements in OnQ. We welcome your questions (come talk after class or make an office hour appointment) and we will do our best to be responsive to email queries within 48 hours (please keep in mind this does not include weekends and should only be used for personal/non - content related matters). It is ok to make mistakes, we are all learning, if you have concerns about your progress in the course, please let us know, so we can help. We want you to learn and have designed this course with your success in mind, if you are concerned you will not be able to complete an assessment or reach a deadline please let us know and we can work together to find a solution.

Expectations for Students:
We ask that you attend classes as much as you can, although we will not be taking attendance. Students will get the most out of these lectures by attending class. We will endeavor to lecture capture as best as possible, and will post recorded lectures and class notes after class. However, we cannot guarantee that every lecture will be recorded, therefore **do not solely rely** on posted recorded lectures as the sole method to obtain the delivered lecture/class. The best way to learn is to attend class and ask questions when the material is fresh in your minds!

Students are expected to be familiar with course materials posted through OnQ and to seek answers to questions using this resource before contacting the instructors. As such, students are expected to monitor OnQ for class announcements and to access class notes through OnQ before attending class. Some material will only be provided in class and if you are unable to attend it is your responsibility to obtain any missed material from a classmate if the lecture is not captured or posted. Academic integrity is important, and we expect all members of the course to properly attribute the creator of any content, submission of someone else's work as your own is not acceptable and will be dealt with following the University's policy. Our class is a place of inclusion where all students are welcome and where interaction with each other will be respectful and constructive.

Expectations for Interactions:
Throughout this course, there will be opportunities for you to interact with your instructor and your classmates. Students will interact with their peers and have opportunities to learn from their colleagues during learning activities that include group presentations. You are expected to behave with integrity at all times both in face-to-face interactions and when engaging with each other online. See the netiquette and discussion guidelines below which we expect everyone to adhere to when interacting with one another whether in person or online.

Fostering Accessibility
All of us have a shared responsibility for reducing barriers to learning and fostering accessibility and promoting meaningful inclusion of those with disabilities. The Accessibility Hub at Queen's University's Human Rights & Equity Office offer a host of tutorials that provide us all with practical tips for:

- creating accessible documents, e.g., to submit to your teaching team or share with peers in peer feedback activities/in a presentation,
- emails, e.g., while communicating with group members or your teaching team, and
- meeting practices (e.g., in tutorials/labs/seminars or virtual meetings.

Name/Pronoun
If, for whatever reason, you wish to change how your name appears in onQ and/or on class lists, please follow these steps. You may also use this process to add your pronouns to the appearance of your name.

1. Log into SOLUS.
2. Click on Personal Information tab.
3. Click on the Names tab

4. Click on the Add New Name tab
5. Choose Preferred from the Name Type drop down menu
6. Enter the name you would like to appear in onQ and/or on class lists.
7. Click Save.

Please allow 24 to 48 hours for your name to be registered within the system. If you have further questions or concerns, please contact ITS at Queen's University.

Assessment

Assessment	Applicable learning outcomes	Assessment Weight
Mid term [redacted]	1) Identify important features of peptide, protein, nucleic acid and carbohydrate structures. Recommend and illustrate structure determination techniques and 2) Propose reaction mechanisms for enzyme-catalyzed reactions that produce amino acid, nucleic acid and carbohydrate based biomolecules	25-35% (Whichever is best for you)
Assignments (2 total)	1), 2) and 3) Demonstrate the interconnections between molecule classes in the central dogma of molecular biology by designing nucleic acid sequences based on protein sequences and vice versa	20% (10% Each)
Presentations ((i) in groups of 4, 15 min (ii) participation in peer review)	1, 2, 3 and 4) Collaborate with a small group of peers to deliver a presentation, on a topic of biological importance, which extends and applies course concepts	20%
Final Exam (during exam period in April)	1, 2, and 3	25-35% (Whichever is best for you)

Essential Requirements and Flexibility to Succeed

Assignments
This course will have 2 Assignments, given out approximately in weeks 3 and 9. You will have 1-2 weeks to complete each assignment. Students can choose to hand in assignments **individually or in groups of up to three students**. Assignments will have a 72-hour grace period: that is, the assignment is due on the date posted, but will be accepted, without penalty, up to 72 hours afterwards. After 72 hours, a 10% penalty per day will be deducted for late submissions. Short term academic consideration is therefore built into all assignment due dates and will not be extended past this 3-day grace period for students without long-term academic consideration or accommodations for disabilities. *Note:* if students hand in assignments as a group, all students will receive the same mark. If students choose to work as a group, they do not have to remain as the same group throughout the course but can change this as the course proceeds. Long-term academic considerations and accommodations cannot be granted if submitting assignments as a group.

Grading Method
All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale:

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

Suggested Time Commitment
In this course, you should expect to invest on average 8 to 10 hours per week. This will include the time you spend in class or lab/tutorial, studying course material, and completing weekly homework or preparing for your larger assignments and exams. You are encouraged to use a term at a glance and a weekly study schedule (visit SASS) that distributes the 8-10 hours per week and avoid 'cramming'. This way you will be more likely to complete the course successfully and remember what you learned longer.

Statement of the Location and Timing of Final Examinations
The exam dates for each Term are listed on the Faculty of Arts and Science webpage under Important Dates. Student exam schedules for the Fall Term are posted via SOLUS immediately prior to the Thanksgiving holiday; they are posted on the Friday before Reading Week for the Winter Term and for the summer term, they are individually noted on the Arts and Science Online syllabi. **Students should delay finalizing any travel plans until after the examination schedule has been posted. Exams will not be moved or deferred to accommodate employment, travel/holiday plans or flight reservations**.

Deferred Exams
Students receiving permission to write a deferred mid-year or final exam will be expected to write their exam during the Faculty of Arts and Science deferred exam period, May 15 to 18 2026, with exact time, date, and location TBA. Requests for individualized deferred exam dates will not be accommodated. The deferred exam is considered an official exam to which all the exam regulations apply.

Required Course Textbooks
This course does not have a required textbook

Other Required Materials

Resource	Resource Type	Access	Cost	Further Information
Lecture Slides	Lecture Notes	OnQ	Free	Uploaded prior to each lecture

Supplemental Materials

Resource	Resource Type	Access	Cost	Further Information
Lecture Recordings	Other	OnQ	Free	Uploaded after lectures

Questions about the Course and Contacting the Teaching Team
Throughout this course, you may come upon some general questions about the course and any assignments. You have several options, you can come chat with your instructor after class or make an office hour appointment. Any other questions that you would prefer to ask privately, can be addressed in person or by email using the addresses listed at the top of this syllabus.

Calculator Policy
As noted in Academic Regulation 9.2, "Calculators acceptable for use during quizzes, tests and examinations are intended to support the basic calculating functions required by most Arts and Science courses. For this purpose, the use of the **Casio 991 series calculator** is permitted and is the only approved calculator for Arts and Science students."

Copyright of Course Materials
Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other similar course materials, are the instructor's intellectual property. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution (including note sharing sites), posting, sale or other means of dissemination without the instructor's *express consent.* A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights.

Academic Integrity
Queen's University is dedicated to creating a scholarly community free to explore a range of ideas, to build and advance knowledge and to share the ideas and knowledge that emerge from a range of intellectual pursuits. Each core value of academic integrity, as defined in the Senate Academic Integrity Policy, gives rise to and supports the next.

Honesty appears in presenting one's own academic work, whether in the context of an examination, written assignment, laboratory or seminar presentation. It is in researching one's own work for course assignments, acknowledging dependence on the ideas or words of another and in distinguishing one's own ideas and thoughts from other sources. It is also present in faithfully reporting laboratory results even when they do not conform to an original hypothesis. Further, honesty is present in truthfully communicating in written and/or oral exchanges with instructors, peers and other individuals (e.g. teaching assistants, proctors, university staff and/or university administrators).
Trust exists in an environment in which one's own ideas can be expressed without fear of ridicule or fear that someone else will take credit for them.
Fairness appears in the proper and full acknowledgement of the contributions of collaborators in group projects and in the full participation of partners in collaborative projects.
Respect, in a general sense, is part of an intellectual community that recognizes the participatory nature of the learning process and honours and respects a wide range of opinions and ideas. However, "respect" appears in a very particular sense when students attend class, pay attention, contribute to discussion and submit papers on time; instructors "show respect by taking students' ideas seriously, by recognizing them as individuals, helping them develop their ideas, providing full and honest feedback on their work, and valuing their perspectives and their goals" ("The Fundamental Values of Academic Integrity", 3rd Edition, p. 8).
Ultimately, responsibility is both personal and collective and engages students, administrators, faculty and staff in creating and maintaining a learning environment supported by and supporting academic integrity.
Courage differs from the preceding values by being more a quality or capacity of character – "the capacity to act in accordance with one's values despite fear" ("The Fundamental Values of Academic Integrity", 3rd edition, p. 10). Courage is displayed by students who make choices and integrous decisions that are followed by action, even in the face of peer pressure to cheat, copy another's material, provide their own work to others to facilitate cheating, or otherwise represent themselves dishonestly. Students also display courage by acknowledging prior wrongdoing and taking proactive measures to rectify any associated negative impact.
All of these values are not merely abstract but are expressed in and reinforced by the University's policies and practices.

Generative Artificial Intelligence (AI) Tools

- **Permitted in specific assignments, with citation**
    - Students must submit their own work and cite the work that is not theirs. Generative AI writing tools such as ChatGPT are only permissible when explicitly noted in the assignment instructions. In these cases, be sure to cite the material that they generate. Any other use constitutes a departure from academic integrity.

Queen's Student Academic Success Services (SASS) offers a self-directed, online academic integrity module which we encourage all students to take which will help with:

- Understanding the nature of the academic integrity departure
- Understanding the expectations of and role of sources in scholarly writing
- Integrating sources into your writing (paraphrasing, quoting, summarizing)
- Understanding when and how to cite your sources
- Managing your time effectively to avoid the need for shortcuts

- Taking effective notes to ensure accuracy of source material and correct attribution

Academic Support

All undergraduate students face new learning and writing challenges as they progress through university: essays and reports become more complex; effectively incorporating research into writing becomes more important; the types of assignments become more diverse; managing your time and developing the skills you need to read and think critically gets more challenging. We encourage students to contact Student Academic Success Services (SASS). SASS offers many different ways to receive support:

- Free online or in-person appointments to get personalized support on writing and academic skills from expert staff and trained peers.
- Workshops and drop-in programs. SASS' Events Calendar lists events coming soon.
- Online resources that provide strategies for academic skills and writing development at university.
- If English is not your first language, SASS has specific resources for English as Additional Language students, including weekly programs and EAL academic skills appointments. You can meet on an ongoing basis with an EAL consultant to work on your academic writing, speaking, listening, and reading skills.

Accommodations for Disabilities

Queen's University is committed to working with students with disabilities to remove barriers to their academic goals. Queen's Student Accessibility Services (QSAS), students with disabilities, instructors, and faculty staff work together to provide and implement academic accommodations designed to allow students with disabilities equitable access to all course material (including in-class as well as exams). If you are a student currently experiencing barriers to your academics due to disability related reasons, and you would like to understand whether academic accommodations could support the removal of those barriers, please visit the QSAS website to learn more about academic accommodations or start the registration process with QSAS by clicking ***Access Ventus*** button at **Ventus | Accessibility Services | Queen's (queensu.ca)**

VENTUS is an online portal that connects students, instructors, Queen's Student Accessibility Services, the Exam's Office and other support services in the process to request, assess, and implement academic accommodations.

To learn more go to: https://www.queensu.ca/ventus-support/students/visual-guide-ventus-students

Academic Consideration for Students in Extenuating Circumstances

Academic Consideration is a process for the University community to provide a compassionate response to assist students experiencing unforeseen, short-term extenuating circumstances that may impact or impede a student's ability to complete their academics. This may include but is not limited to any extenuating circumstance (illness, bereavement, traumatic event, injury, family emergency, etc.) which is short-lived, begins within the term, and will not last longer than 12

weeks - see Academic Consideration webpage for details (https://www.queensu.ca/artsci/undergraduate/student-services/academic-consideration)

> Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. For more information, undergraduate students in the Faculty of Arts and Sciences should consult the Faculty's webpage on Academic Consideration in Extenuating Circumstances and submit a request via the Academic Consideration Request Portal. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

Students are encouraged to submit requests as soon as the need becomes apparent and to contact their instructor and/or course coordinator as soon as possible once academic consideration has been granted. Any delay in contact may limit the options available for academic consideration. While we encourage instructors to accommodate, each instructor has discretion in deciding whether or how to apply the Academic Consideration. For more information on the Academic Consideration process, what is and is not an extenuating circumstance, and to submit an Academic Consideration request, please see the Faculty of Arts and Science's Academic Consideration website. ASO courses include links to information on **Academic Consideration** on your **Course Homepage** in onQ.

Please see the Teaching Team page for contact information for your instructors where relevant.

For more information, please see the Senate Policy on Academic Consideration for Students in Extenuating Circumstances.

Discussion Guidelines

University is a place to share, question and challenge ideas. Each student brings a different lived experience from which to draw upon. To help one another learn the most we can from this experience please consider the following guidelines.

1. Make a personal commitment to learn about, understand, and support your peers.
2. Assume the best of others and expect the best of them.
3. Acknowledge the impact of oppression on the lives of other people and make sure your writing is respectful and inclusive.
4. Recognize and value the experiences, abilities, and knowledge each person brings.
5. Pay close attention to what your peers write before you respond. Think through and re-read your writings before you post or send them to others.
6. It's ok to disagree with ideas, but do not make personal attacks.
7. Be open to being challenged or confronted on your ideas and to challenging others with the intent of facilitating growth. Do not demean or embarrass others.
8. Encourage others to develop and share their ideas.