

Syllabus CHEM 416/816:
Advanced Biological and Bioanalytical Chemistry (CHEM 416)
Biological Chemistry Techniques (CHEM 816)

Fall Term 2026

On Campus (3 credits)

Pre-requisites: CHEM 323 or BCHM 310 or (BCHM 315 and BCHM316)

Lectures: Will be held in [REDACTED]



Course instructors

[Dr. Chantelle Capicciotti \(she/her\)](#)

Email: c.capicciotti@queensu.ca

Office: rm 405

Phone number: 613-533-2627

Dr. Avena Ross (she/her)

Email: avena.ross@chem.queensu.ca

[Office: rm 407](#)

[Phone number: 613-533-2618](#)

Course Description: An advanced discussion of the chemical basis of biologically relevant molecules, pathways and methods of their characterization. Topics covered will draw from advanced properties, characterization and application of DNA/RNA, proteins/peptides, lipids, carbohydrates, alkaloids, terpenes and polyketides and bioanalytical/molecular biology techniques.

Learning Hours: 120 (32 Lecture, 4 Seminar, 12 Online Activity, 72 Private Study)

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, book an office hour time or post in the OnQ discussion forum. Please reserve email questions for personal or private matters.

Lectures will use a combination of powerpoint slides and handwritten notes. The last 4-5 classes of the course will be dedicated to group in-class presentations on timely, advanced biological chemistry topics.

Important University Dates

Key dates (first day of class, tuition due date, last day to add/drop courses) are important to your academic success. Please visit the [Faculty of Arts and Sciences Sessional Dates website](#) for all academic deadlines.

Please note that the last day of classes is Tuesday, December 8th, as indicated in SOLUS.

Welcome Message

Welcome to CHEM 416/816! We are your instructors, Dr. Capicciotti and Dr. Ross. 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 designing experiments based on biological principles to learn more about the 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). 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.

For Students:

We ask that you attend classes as much as you can, although we will not be taking attendance. Sections of certain lectures will involve class discussions on methods and problem solving breakdown. 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, 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.

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.

Intended Course Learning Outcomes

At the end of CHEM 416/816, students will be able to...

1. Propose reasonable chemical mechanistic hypotheses for production of biomolecules
2. Evaluate and articulate appropriate chemical analytical and bioanalytical techniques for investigating biomolecule structure, function and application
3. Develop an appreciation of how chemistry can be applied to study biomolecules, and how biomolecules can be synthesized or produced using molecular biology tools
4. Apply their understanding of biomolecule synthesis and production, and chemical/bioanalytical techniques, to new topic areas within biological chemistry, assessment of the new topic will include an analysis of the contribution of indigenous knowledge and the impact of colonial science.

Approximate Content Timeline

Week	Content Covered (Tentative)	Assessments (Tentative)
Week 1: Sept. 8 - 11	Refresh of Biological Molecules and Introduce Bioanalytical Techniques for Proteins Proteins – Expression and Synthesis, Characterization, Advanced Properties and applications	
Week 2: Sept. 14 - 18	Proteins – Expression and Synthesis, Characterization, Advanced Properties and applications	
Week 3: Sept. 21 - 25	Proteins – Expression and Synthesis, Characterization, Advanced Properties and applications Carbohydrates -Introduction, Characterization, Synthesis, Advanced and Applications	Assignment #1 Posted (416/816)
Week 4: Sept. 28 - Oct. 2	Carbohydrates -Introduction, Characterization, Synthesis, Advanced and Applications	Assignment #1 Due (416/816)
Week 5: Sept. Oct. 5 -9	Carbohydrates -Characterization, Synthesis, Properties and Applications	Literature Assignment #1 Posted (816)

Reading Week: Oct. 12 - 16		
Week 6: Oct. 19 - 23	Carbohydrates - Characterization, Synthesis, Advanced and Applications Peptide Biosynthesis: Studying RiPPs, ATP Grasp enzymes using molecular cloning	Mid-term (416/816) 
Week 7: Oct. 26 - 30	Peptide Biosynthesis: Studying RiPPs, ATP Grasp enzymes using molecular cloning	Literature Assignment #1 Due (816)
Week 8: Nov. 2 - 6	Peptide Biosynthesis: More about cloning and intro to NRPSs	
Week 9: Nov. 9 - 13	Polyketide Biosynthesis: Structure, Biosynthesis, pathway CAPTURE	Assignment #2 Posted (416/816)
Week 10: Nov. 16 - 20	Alkaloids/Terpenes: Structure, Biosynthesis, Applications	Assignment #2 Due (416/816)
Week 11: Nov. 23 - 27	Revisit Bioanalytical Techniques and Experimental Design	Literature Assignment #2 Posted (816)
Week 12: Nov. 30 – Dec. 4	Group Presentations	Presentations (416/816)
Week 13: Dec. 7 - 8	Group Presentations	Presentations (416/816) Literature Assignment #2 Due (816)

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 in January 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.

Assessments – CHEM 416

Assessment	Applicable learning outcomes	Assessment Weight
Assignments (2 in total)	1) and 2) Evaluate and articulate appropriate chemical analytical and bioanalytical techniques for investigating biomolecule structure, function and application	20% (10% Each)
Presentations	1, 2, 3 and 4) Apply their understanding of biomolecule synthesis and production, and chemical/bioanalytical techniques, to new topic areas within biological chemistry, assessment of the new topic will include an analysis of the contribution of indigenous knowledge and the impact of colonial science.	20%
Exams (Midterm and Final Exam)	1, 2, 3 and 4	60% Total: 25-35% each (Whichever is best for you)

Assessments – CHEM 816

Assessment	Applicable learning outcomes	Assessment Weight
Assignments (2 in total)	1) and 2) Evaluate and articulate appropriate chemical analytical and bioanalytical techniques for investigating biomolecule structure, function and application	20% (10% Each)
Literature Assignments (2 in total)	2, 3 and 4	20% (10% Each)
Presentations	1, 2, 3 and 4) Apply their understanding of biomolecule synthesis and production, and chemical/bioanalytical techniques, to new topic areas within biological chemistry, assessment of the new topic will include an analysis of the contribution of indigenous knowledge and the impact of colonial science.	20%
Exams (Midterm and Final Exam)	1, 2, 3 and 4	40% Total: 15-25% each (Whichever is best for you)

Essential Requirements and Flexibility to Succeed**Assignments**

This course will have 2 Assignments, given out approximately in week 3 and week 9. You will have 1 week to complete the assignment. Students can choose to hand in assignments **individually or in groups of up to three students for both CHEM 416 and 816**. Assignments will have a 24 hour grace period: that is, the assignment is due on the date posted, but will be accepted, without penalty, up to 24 hours afterwards. After 24 hours, a 10% penalty per day will be deducted for late submissions. Please discuss any short-term accommodations needed that are uploaded in Ventus.

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, and can change groups as the course proceeds. Short-term accommodations cannot be granted if submitted assignments as a group.

Literature Assignments (CHEM 816 Only)

CHEM 816 will have 2 Literature Assignments, given out approximately in week 5 and week 11. You will have 1-2 weeks to complete the assignment. Literature assignments must be **completed individually**. Assignments will have a 24 hour grace period: that is, the assignment is due on the date posted, but will be accepted, without penalty, up to 24 hours afterwards. After 24 hours, a 10% penalty per day will be deducted for late submissions. Please discuss any short-term accommodations needed that are uploaded in Ventus.

Presentation (TBA, tentatively last 4 classes)

Time: 15 minutes total – 10-12 minutes for presentation, 3 minutes for questions

Topic: Recent advancement in biological chemistry. Should be based on a publication within the last 5 years. Topics needs to be approved by instructors.

Format: Formal presentation in groups of 3. More details and key dates will be provided later in the course.

Grading Scheme and 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

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 or, you are invited to post your question in the Course Questions discussion forum in OnQ. Feel free to help answer your peers' questions on this forum. The teaching team will monitor this discussion forum and answer questions. Most questions are answered within 48 hours. 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."

Web Browsers

onQ performs best when using the most recent version of the web browsers, Chrome or Firefox. Safari and Edge are strongly discouraged as these web browsers are known to cause issues with onQ.

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.

Queen's Policy Statement on 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.

In this course you are permitted to work with a partner or in groups of up to 3 to encourage collaboration, cooperation, and collective learning on lab/tutorial assignments that are designated as "group work". You are not permitted to share answers among large groups or as a tutorial group. You must work independently on all assignments, exams, quizzes and 'pop questions' designated as "individual work".

Statement for Generative Artificial Intelligence (AI) Tools

Using generative AI writing tools such as ChatGPT in your submitted work is **not permitted** in this class. Submitting AI-generated content constitutes a departure from academic integrity as defined by university Academic Integrity procedures. Original work, completed wholly by you, where reference material is properly cited (e.g. journal articles, review articles, etc) is expected to be submitted in this course.

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,

- **Short term Physical or Mental Illness or Injury (stomach flu, anxiety/depression, mononucleosis, concussion, broken bones, surgery, medical treatments, etc.)**
- **Traumatic Event/Confidential (Bereavement, serious injury, illness or required treatment for a significant other/family member or a traumatic event such as divorce, sexual assault, social injustice, etc.)**
- **Requirements by Law or Public Health Authorities (court dates, jury duty, requirements to isolate, etc.)**
- **Significant Event (varsity athletic event, distinguished event, serving in the Reserve Forces, etc.)**

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances. For more information, please see the [Senate Policy on Academic Consideration for Students in Extenuating Circumstances](#).

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.

If you need to request academic consideration for this course, you will be required to provide the name and email address of the instructor/coordinator. Please use the following:

Instructor/Coordinator Name: Avena Ross, Chantelle Capicciotti

Instructor/Coordinator email address: avena.ross@queensu.ca, c.capicciotti@queensu.ca

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 instructor and TA(s), where relevant.

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.