

**Syllabus CHEM/ENCH 323:
Biological Chemistry
Winter term 2022**

Course instructor

Dr Avena Ross
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CHEM/ENCH 323 will be taught as a remote course using OnQ for the first 6 weeks of semester and will then be in person for the second 6 weeks. (Pending further changes to delivery specified by the University)

Remote component (Week 1-6)

Lectures: Will consist of asynchronous video recordings posted in OnQ each week

Office Hours: Will be offered through Zoom by appointment, email Instructor to book

In-person component (Week 7-12)

Lectures: Will be held in Miller Hall rm 201 Monday 1:30pm, Wednesday 12:30pm and Friday 11:30am

Office Hours: Will be offered by appointment, email Instructor to book

For the remote component of the course weekly modules will be available through OnQ, that will consist of a guided combination of video mini-lectures, with accompanying frame for the lecture notes, useful extra reading and occasional discussion questions. You can ask questions by scheduling office hours with Dr. Ross or by posting in the discussion forum.

For the in-person component lectures will use a combination of powerpoint slides and handwritten notes, pre-recorded lectures will still be available through OnQ if you are unable to attend in person due to illness or quarantine requirements. The last 2 weeks of the course will be dedicated to group presentations on timely Biological Chemistry topics, the exact format will be determined closer to the time

Intended Student Learning Outcomes

At the end of CHEM 323, students will be able to...

- Identify important features of protein structure. Recommend and illustrate structure determination techniques.
- Articulate the meaning of kinetic parameters and justify how they are altered during enzyme inhibition
- Propose reaction mechanisms for enzyme-catalyzed reactions that produce peptide and nucleic acid based biomolecules.
- Interpret genetic information and predict the resultant protein structures
- Compare and discuss alternative synthetic and biosynthetic approaches for peptide synthesis

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, metal ion

4. 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, ³RNA, ³RNA synthetases, initiation, recognition, bond formation, termination

5. Peptide Synthesis and Biosynthesis: solution and solid supported synthesis, RiPPs (Ribosomally synthesized and post-translationally modified peptides), NRPs (non-ribosomal peptides)

6. 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

Approximate Content Timeline

Week	Content Covered	Assessments (Tentative)
Week 1 (Jan 10-14)	Introduction to Biological Chemistry and Molecules	
Week 2 (Jan 17-21)	Proteins	Assignment 1 Posted
Week 3 (Jan 24-28)	Proteins	Assignment 1 Due
Week 4 (Jan 31-Feb 4)	Proteins	Assignment 2 Posted
Week 5 (Feb 7-11)	Enzyme Kinetics	Assignment 2 Due
Week 6 (Feb 14-18)	Enzyme Mechanisms	
Reading Week (Feb 21-25)		
Week 7 (Feb 28- Mar 4)	Enzyme Mechanisms	Mid Term Exam, Assignment 3 Posted
Week 8 (Mar 7-11)	Nucleic Acids	
Week 9 (Mar 14-18)	Nucleic Acids	Assignment 3 Due
Week 10 (Mar 21-25)	Peptide Synthesis and Biosynthesis	Assignment 4 Posted
Week 11 (Mar 28- Apr 1)	Group Presentations	
Week 12 (Apr 4-8)	Group Presentations	Assignment 4 Due

Grading Scheme

- presentation: (i) (in groups of 4, 15 min) (ii) active participation in question session **15%**
- assignments (up to 4 in total) **20%**
- OnQ mid-term is tentatively scheduled for Mar 4th 3:30-5:30pm (EST) **25%**
- In-person or OnQ final (Date and format to be announced) **40%**

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

Recommended textbook

Biochemistry, Voet & Voet, 4th edition

Note: older editions are also accepted (just make sure that there is no ambiguity on the assigned reading, either with your fellow students or with the instructor)

Additional useful textbooks

- **Foundations of Chemical Biology**, C.M. Dobson, J. A. Gerrard, A. J. Pratt, Oxford Chemistry Primers, Oxford University Press: this very short (92 pages) summarizes the essentials in an easy-to-read manner. This is an ebook available through the library.
- **Organic Chemistry**, Clayden, Greeves & Warren: strong Organic Chemistry refresher

Useful websites

a) *To read more:* **Encyclopedia of Biological Chemistry:**

<http://www.sciencedirect.com/science/referenceworks/9780124437104>

A collection of short review articles written by experts, A wonderful complement to the textbook!

b) *For research:*

- **Web of Science** (Access Through Databases Tab at <http://library.queensu.ca/>)

This is a searchable database for scientific literature. Very helpful for finding journal articles by topic searching and for then finding other research that is related to those articles.

- **National Center for Biotechnology Information (NCBI):** <https://www.ncbi.nlm.nih.gov/> for journal articles, protein sequences, DNA sequences, align protein sequences (BLAST), find protein structures and lots more

- **ExPASy Proteomics Server** (also known as Swiss-Prot): <http://ca.expasy.org/>
This an annotated database dedicated to proteins, which also contains lots of useful online tools for protein sequence and structure analysis. A user-friendly protein structure viewer is available for download as well (<http://ca.expasy.org/spdbv/>).

- **Protein Data Bank:** <https://www.rcsb.org/>
This is where structures of proteins or nucleic acids, determined by X-ray or NMR, are deposited. You can search for a biomolecule then download the file to your own PC for viewing on PyMOL or Swiss-PDBView

- **Nucleic Acids Database:** <http://ndbserver.rutgers.edu/>
More sources of nucleic acids structures (X-ray or NMR). Advanced searches are possible. Download the file to your own computer and view with free software.

Useful software:

Download one (or both) of the following FREE programs for viewing and analyzing 3-dimensional structures of biomolecules:

PyMol: <http://www.pymol.org/>

Swiss PDB-Viewer: <http://ca.expasy.org/spdbv/>

Late Policy

Assignments must be handed in on or before the due date to the appropriate OnQ drop box. Late assignments will be given a penalty of 10% per day. If you don't think you can make a deadline please contact me **before** the due date so we can work something out. Note all academic consideration for *missed* quizzes, tests, midterms, presentations, and assignments is now processed through the faculty portal see Academic Considerations for Students in Extenuating Circumstances section below.

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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

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.”

Technology

This course will have synchronous sessions hosted through Zoom for office hours, you will get the best experience if you have access to a webcam and headset.

Students are encouraged when possible to work with the most recent versions of software including web browsers, Java, Flash and Adobe Reader.

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.

Internet Speed

While wired internet connection is encouraged, we recognize that students may be relying on a wireless connection. A minimum download speed of 10 Mbps and up to 20 Mbps for multimedia is recommended. To test your internet speed, <https://www.speedtest.net/>

For technology support ranging from setting up your device, issues with onQ to installing software, contact ITS Support Centre <https://www.queensu.ca/its/itsc>

Academic Integrity

Queen’s students, faculty, administrators and staff all have responsibilities for upholding the fundamental values of academic integrity; honesty, trust, fairness, respect, responsibility and courage (see www.academicintegrity.org). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities <http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities>).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and their behaviour conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1>), on the Arts and Science website (see <https://www.queensu.ca/artsci/students-at-queens/academic-integrity>), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

- *In this course you are permitted to work with a partner or in groups of up to 4 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”.*

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 intellectual property of the instructor. 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, 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.

Accommodations for Disabilities

Queen's University is committed to achieving full accessibility for people with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016 (see <https://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslcwww/files/files/policies/senateandtrustees/ACADACCOMMPOLICY2016.pdf>). If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the Queen's Student Accessibility Services (QSAS) and register as early as possible. For more information, including important deadlines, please visit the QSAS website at: <http://www.queensu.ca/studentwellness/accessibility-services/>

Academic Considerations for Students in Extenuating Circumstances

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and are interfering with their ability to complete academic requirements related to a course for a short period of time. The Senate Policy on Academic Consideration for Students in Extenuating Circumstances is available at <http://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslclwww/files/files/policies/senateandtrustees/Academic%20Considerations%20for%20Extenuating%20Circumstances%20Policy%20Final.pdf>

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. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the portal where a request can be submitted at: <http://www.queensu.ca/artsci/accommodations>. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

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

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

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; for the Winter Term they are posted on the Friday before Reading Week, 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.**

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.