

**Syllabus CHEM/ENCH 323:  
Biological Chemistry  
Winter term 2021**

**Course instructor**

Dr Avena Ross  
email: [avena.ross@chem.queensu.ca](mailto:avena.ross@chem.queensu.ca)

**CHEM/ENCH 323 is a remote course taught using OnQ**

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

**Tutorial Help Sessions:** Will be synchronous (live) and offered using Zoom on Fridays 10:30-11:30 am (*Tutorial attendance is not compulsory*)

**Office Hours:** Will be offered through Zoom on Tuesdays 9:30-10:30 am (or by appointment, email Instructor to book)

Each week a new module of the course will be released through OnQ, it 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 attending office hours with Dr. Ross or the Tutorial help session with the TA or by posting in the discussion forum.

**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, <sup>3</sup>RNA, <sup>3</sup>RNA 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 Presentation videos on Biological Chemistry Topics:** A project where groups of 4 students will research a Biological Chemistry topic and then record a 15 min video to teach the rest of the class about this topic

### Approximate Content Timeline

Weeks	Content Covered	Assessments (Tentative)
Week 1 (Jan 11-15)	Introduction to Biological Chemistry and Molecules	
Week 2 (Jan 18-22)	Proteins	Assignment 1 Posted
Week 3 (Jan 25-29)	Proteins	Assignment 1 Due
Week 4 (Feb 1-5)	Proteins	Assignment 2 Posted
Week 5 (Feb 8-12)	Enzyme Kinetics	Assignment 2 Due
Reading Week (Feb 15-19)		
Week 6 (Feb 22-26)	Enzyme Mechanisms	Mid Term Exam
Week 7 (Mar 1-5)	Enzyme Mechanisms	Assignment 3 Posted
Week 8 (Mar 8-12)	Nucleic Acids	Assignment 3 Due
Week 9 (Mar 15-19)	Nucleic Acids	
Week 10 (Mar 22-26)	Peptide Synthesis and Biosynthesis	Assignment 4 Posted
Week 11 (Mar 29- Apr 2)	Presentations	Assignment 4 Due
Week 12 (Apr 6-9)	Presentations	

### Grading Scheme

- participation: (i) in the course and (ii) presentation (in groups of 4, 15 min) **15%**
- assignments (up to 4 in total) **20%**
- OnQ mid-term (not proctored) is tentatively scheduled for Feb 24<sup>th</sup> 7-9pm (EST) **25%**
- OnQ final (not proctored, Date 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, 4<sup>th</sup> 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. Extensions will be granted only in exceptional circumstances and must be discussed with me before the due date. 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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*Queen's Official Grade Conversion Scale*

<b>Grade</b>	<b>Numerical Course Average (Range)</b>
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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 Microsoft Zoom for tutorials/help sessions and 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>

**Notice of Recording**

Synchronous (live) tutorials will be delivered in this course through video conferencing platforms supported by the University [Zoom]. Steps have been taken by the University to configure these platforms in a secure manner. Tutorials may be recorded with video and audio (and in some cases transcription) and if so will be made available to students in the course for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen’s University, please see the general [Notice of Collection, Use and Disclosure of Personal Information](#).

### **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](http://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.uslcwww/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](mailto: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.**

### **Remote Exams**

For exams being offered remotely, Regulation 7.2.3. [Restrictions on Assessment](#) is waived. Remote exams will be allowed in the last two weeks of classes and in the study period designated by Senate prior to the examination period in order to accommodate the limited number of online proctoring seats available.

**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.