



# Chemistry

UNIVERSITY OF TORONTO

## CHM 1263H: Bioinorganic Chemistry Winter Course Syllabus

### I Instructor

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#### INSTRUCTOR

Name: Robert Morris

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Office: Davenport Labs, room 344, 80 Saint George St.

**Student hours:** Davenport Labs, room 344.

In person student hours: 4-5 pm Mondays Jan.-Apr. or by appointment arranged by email.

Research: <https://www.chemistry.utoronto.ca/people/directories/all-faculty/robert-morris>

### II COURSE OVERVIEW

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#### COURSE DESCRIPTION:

Essential elements, harmful elements, naturally occurring ligands, chelating ligands, ligands used in chelate therapy, functions of metals, principles of bioinorganic coordination chemistry, template effect, spontaneous self-assembly, properties of biological molecules, transport of metal ions, control and utilization of metal-ion concentrations, DNA binding, enzymes exploiting acid catalysis, developing artificial hydrolytic metalloenzymes, zinc fingers, electron transfer and energy sources for life, iron-sulfur proteins, Mossbauer spectroscopy, hydrogenases, nitrogenase, atom and group transfer chemistry, redox enzymes, biomineralization, metals in medicine, radiopharmaceuticals.

#### STUDENT LEARNING OUTCOMES:

Recognize how the fundamental principles of inorganic chemistry apply to bioinorganic systems.

Appreciate how Nature acquires and places trace elements for use in life processes.

Understand the application of specialized methods used to study bioinorganic molecules.

Discuss the chemistry and biology of specific bioinorganic systems and model metal complexes.

Discuss the use of metals in medicine.

#### PREREQUISITE COURSES:

This course assumes you have a basic understanding of transition metal coordination chemistry from a full year course in introductory inorganic chemistry such as CHM238Y/CHM236+CHM237 and a knowledge of biochemistry.

CHM236+CHM237 may not be taken concurrently with CHM1263S. A biochemistry course and an advanced inorganic chemistry course such as CHM338H are strongly recommended.

Exclusion: Equivalent course in Bioinorganic Chemistry or Inorganic Biological Chemistry

**READINGS:**

**Required:** Course notes and materials from the QUERCUS website.

Supplemental: Biological Inorganic Chemistry, 3rd ed., Robert R. Crichton, 2019

<https://www.sciencedirect-com.myaccess.library.utoronto.ca/book/9780128117415/biological-inorganic-chemistry>

Bioinorganic Chemistry by Dieter Rehder, Oxford University Press, 2014

ISBN: 9780199655199

Guided Tours of Metalloproteins: [The Guided Tours of Metalloproteins \(GTM\) \(utoronto.ca\)](#)

### III COURSE ORGANIZATION

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This course is organized by two classes each week (Tues. and Thurs. at 4:00 pm ET) starting on Tuesday January 9, 2024 at BL114, 140 St. George Street Bissell Bld (north bld of Robarts library).

Over the course of each week, you are expected to attend and participate in the classes and submit assignments according to the due dates/deadlines.

**COURSE SCHEDULE & RELEVANT SESSIONAL DATES:**

DATES	UNIT/WEEK	TOPICS
Jan. 9-25	1,2,3	Introduction, essential elements, biocoordination chemistry, metal ion transport
Feb. 1 Feb. 1 – Feb. 15	4,5,6	<b>Quiz 1 due on Feb. 1</b> O <sub>2</sub> transport, non-redox proteins, electron carriers, Iron sulfur proteins, cytochromes.
Feb. 19-23		Winter reading week
Feb. 27 Feb. 27, Feb. 29	7	<b>Midterm Assignment due Feb 27, 4:10 pm.</b> Copper blue proteins
Mar. 5-14 Mar. 14	8,9	Nitrogenase, respiration <b>Abstract of presentation due Mar 14, 4:10 pm.</b>
Mar. 19-28 Mar. 28	10,11	Photosynthesis, metals in medicine. <b>Quiz 2 due on Mar. 28</b>
Apr. 2,4 Week of Apr. 1-5	12	<b>Student presentations in class</b> <b>Evening poster session -time to be announced (TBA)</b>
Apr. 5		Classes end
Apr. 10-30		<b>Final assessment period.</b>

## IV EVALUATION/GRADING SCHEME

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### OVERVIEW:

QUIZZES (two in total, best mark of the two) worth 10%

MIDTERM ASSIGNMENT (due Feb. 27) worth 20%

PRESENTATION ABSTRACT (due Mar. 14) worth 5%

STUDENT PRESENTATION due Apr. 1-5 (TBA) worth 30%

FINAL ASSESSMENT during Apr. 10-30 (TBA). Worth 35%

TOTAL:  $10\%+20\%+5\%+30\%+35\%=100\%$

### ASSESSMENT DATES & MARK BREAKDOWN:

1. Quiz 1 (10%\*, Thursday February 1): 1 hour, to be written anytime within a 24-hour window between 12:00 a.m. – 11:59 p.m. ET.
2. Midterm assignment (20%, due Tuesday February 27 at 4:10 pm).
3. Abstract of presentation (5%, due Thursday March 14<sup>th</sup> at 4:10 pm)
4. Quiz 2 (10%\*, Thursday 28<sup>th</sup> March): 1 hour, to be written anytime within a 24-hour window between 12:00 a.m. – 11:59 p.m. ET.
5. Student Presentation (30%, during the week of April 1-5): done in class or during an evening poster session TBA.
6. Final assessment (35%, in the Final Assessment period April 10-30): 3 hours, location and date to be announced.

\*note that if both quizzes are written, the higher grade earned on the two quizzes will be counted. Each quiz will be multiple-choice in nature.

**IMPORTANT:** if an unexpected technical issue occurs with a university system (e.g., Quercus services, network outage) that affects availability or functionality, it may be necessary to revise the timing or weighting of the two quizzes.

## V COURSE POLICIES

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- Each member of this course is expected to maintain a:
  - (i) professional and respectful attitude during all course activities, including classes, laboratories, tutorials, and online activity.
  - (ii) personal calendar/schedule/organizer to ensure that all course activities are completed, and due dates are met.
  - (iii) collection of notes recorded independently based on concepts covered in course activities (students registered with Accessibility Services requiring a class note-taker will have access to this accommodation)
  - (iv) familiarity with the university policy on Academic Integrity (overleaf)
- The University of Toronto is committed to equity, human rights, and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. As a Course Instructor, I will

neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment and hate speech will not be tolerated. If you have any questions, comments, or concerns, we encourage you to reach out to the staff in our Equity Offices.

- If you are absent from your studies due to illness or other reasons and unable to complete course work (the assignment or presentation) then a piece of written documentation is required to be given to Prof. Morris. If you suspect or know that you have a disability that is affecting your studies, [learn about the services and supports available through Accessibility Services](#). A disability can be physical disability, sensory disability, a learning disability, mental health disorder or a short-term disability like an injury. If you are not sure whether you have a disability, you can confidentially contact [Accessibility Services](#) with your questions.
- The use of generative artificial intelligence tools or apps for the assignment and presentation in this course, including tools like ChatGPT and other AI writing assistants, is prohibited.
- I will respond to email within 24 hrs. on weekdays.
- The course materials provided by Prof. Robert Morris should only be used by students of this course and should not be uploaded or shared with others without the permission of Prof. Morris.
- 10% per day will be deducted for a late assignment.
- For students missing the presentation for a valid reason, the presentation will be made individually with Prof. Morris at a mutually agreed upon date before April 26. For students missing the assignment for a valid reason, the mark will be based on the individual performance on the quiz and presentation marks weighted 10/40 and 30/40, respectively.
- Assignments should be handed to Prof. Morris in person in class.
- Work will only be regraded for a valid reason. A request for regrading must be made within 7 days of the due date of the assignment.

## VI TECHNOLOGY REQUIREMENTS

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- Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: <https://www.vicprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/>

- Advice for students writing online assessments (quizzes etc.):  
<https://studentlife.utoronto.ca/task/online-exams-and-tests/>
- This course requires the use of computers, and technical issues are possible. When working on a piece of academic work, students are responsible for scheduling enough time to allow for reasonable delays due to technical difficulties to be overcome, so such issues will not be acceptable grounds for deadline extension. Particularly, maintaining an up-to-date independent backup copy of your work is strongly recommended to guard against hard-drive failures, corrupted files, lost computers, etc.

## VII INSTITUTIONAL POLICIES & SUPPORT

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### ACADEMIC INTEGRITY

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters

([governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019](https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019)) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

On quizzes and term tests:

1. Using or possessing unauthorized aids. **Please note that the use of websites (such as Chegg.com or the course discussion board) to post quiz/term test questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**
2. Looking at someone else's answers or collaborating/discussing answers during a quiz or term test.
3. Misrepresenting your identity.

In general academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional

resources (see [www.academicintegrity.utoronto.ca/](http://www.academicintegrity.utoronto.ca/)).

### **COPYRIGHT**

If a student wishes to copy or reproduce class presentations, course notes or other similar materials provided by instructors, he or she must obtain the instructor's written consent beforehand. Otherwise, all such reproduction is an infringement of copyright and is absolutely prohibited.

### **ACCESSIBILITY NEEDS**

Students with diverse learning styles and needs are extremely welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact [Accessibility Services](#) as soon as possible.

### **ACCOMMODATIONS FOR RELIGIOUS OBSERVANCES**

Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an assignment, tutorial, class or laboratory session. Students must inform the instructor **before** the session/assignment date to arrange accommodations.

### **ADDITIONAL SERVICES & SUPPORT**

The following are some important links to help you with academic and/or technical service and support:

- General student services and resources at [Student Life](#)
- Full library service through [University of Toronto Libraries](#)
- Resources on conducting online research through [University Libraries Research](#)
- Resources on academic support from the [Academic Success Centre](#)
- Learner support at the [Writing Centre](#)
- Information for [Quercus Support](#)

### **ACKNOWLEDGEMENT OF TRADITIONAL LANDS**

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.