

CH 4040/H4040/6040: Bioinorganic Chemistry

Spring 2022

Instructor: Professor Julia Brumaghim

Time/Location: 9:30 –10:45 am Tuesday/Thursday in 158 Hunter (unless you have a specific university accommodation to attend remotely); please wait at least 15 minutes if I am not present at 9:30 am

Required text: Lippard and Berg, *Principles of Bioinorganic Chemistry*. University Science Books, 1994 (ISBN 978-0-935702-72-9). Available online from the Clemson University library.

Office hours: Hunter 459 on Mondays 3–4 pm or by appointment (please email me to schedule a time)

Contact information: Office: 481 Hunter; phone 656-0481; email: brumagh@clemson.edu

COURSE OBJECTIVES AND LEARNING OUTCOMES

This course is intended to provide sufficient background knowledge of the topics and techniques used in bioinorganic chemistry so that students should be able to (1) describe the importance of metals in biological systems including the inorganic and biochemical relevance of the topics listed on p. 3 (e.g., how metal ions interact with biomolecules, what properties of metal ions make them suitable for specific biological functions, and why metal ions are both necessary and toxic) and (2) read and critically evaluate the current literature in this field. As a broader component, this course is also intended to develop general and subject-specific critical thinking skills as defined in the Course Specifics section. Specific skills (such as analysis and/or interpretation of data in figures or tables and analysis of experimental limitations) will be discussed during class as listed on p. 3.

COURSE SPECIFICS

Reading

Appropriate reading from the text is given in the course outline (p. 3); *it is highly recommended that the reading be completed prior to the lecture for which it is assigned.*

Problem sets

Problem sets are due *at the beginning of class* on the indicated days (p. 3) since answer keys will be handed out and/or posted on Canvas during class. Late homework will be not be accepted without a valid excuse.

Exams

The midterm and final exam dates are listed on p. 3. The final exam will focus *primarily* on material from the second half of the course. Make-up exams are given by appointment for excused absences only. Students with learning accommodations should present an appropriate letter from Student Accessibility Services as early as possible in the semester. If there are issues with providing this letter in a timely fashion, please let me know as soon as possible.

Review papers (4040H and 6040 students only)

A review paper in the format of an *Angewandte Chemie* research highlight is required. A recent paper from the inorganic chemistry literature should be selected as the focus of your paper and the paper outline must be approved by 17 March. Further details about this assignment will be given as the course progresses.

Critical thinking development

This is a critical thinking course developed as part of Clemson's CT² initiative that aims to incorporate and develop critical thinking skills in addition to covering the topical course material. Thus, we will also focus on discussing and using the elements of critical thinking. Critical thinking is the ability to interpret and analyze a problem and to determine and evaluate possible solutions. It is a self-reflective process for learning and problem solving that must be cultivated and practiced because it can challenge current beliefs and thought processes. Critical thinking requires both cognition (thinking) and character skills (such as motivation, curiosity, perseverance, intellectual humility, and confidence). These skills are required for the

successful practice of science, and scientists with these skills are widely sought after by graduate schools, pre-professional schools, and employers. Assignments in this course are designed to develop these broadly applicable critical thinking skills.

Attendance and grading

Because of the fast-paced nature of this course, attendance at every class is highly recommended. Grades will be based upon the midterm and final exams as well as the problem sets and the review paper.

Completion of the critical thinking online assessment will result in four bonus points added to the midterm exam score. Final grades will be calculated using the percentages listed below and exams will be graded on a curve so that A: 100-90%, B: 89-80%, C: 79-70%, D: 69-60%, F: <60 %.

	CH 4040	CH 4040H/6040
Problem sets (8)	40 %	40 %
Midterm exam	30 %	20 %
Review papers	N/A	20 %
Final exam	30 %	20 %

Academic Integrity

Official Clemson statement: “As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a ‘high seminary of learning.’ Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.”

Our class statement: Academic dishonesty is a very harmful habit both inside and outside of the university setting. It can (and has in some cases) lead to student expulsion or degree revocation and/or job loss for graduates and for faculty. It benefits everyone, including yourself, to avoid academic dishonesty, including but not limited to cheating and plagiarism. It will not be tolerated in this class and will receive no credit.

Student Accessibility Services

It is university policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students requesting course accommodations should make an appointment with Student Accessibility Services (656-6848; <https://www.clemson.edu/academics/studentaccess/student-resources.html>) in the first month of classes to discuss specific needs. Students should present a Faculty Accommodation Letter from Student Accessibility Services when they meet with instructors. New Faculty Accommodation Letters must be presented each semester, and accommodations are not retroactive.

Clemson University Title IX Statement

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information, or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The policy is located at <https://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Alesia Smith serves as Clemson's Title IX Coordinator and may be reached at alesias@clemson.edu or 656-3181.

Class Cancellation, Moving to Online Instruction, and COVID-Related Absences

If class is canceled due to inclement weather or other unforeseen circumstances, you will be responsible for turning in work or being prepared for test or class assignments during the next class meeting period. Due to the unpredictability of the COVID pandemic, instruction may switch to an entirely online format or syllabus modifications may be required for everyone’s health and safety. Course modifications will be announced with as much lead time as possible and posted on Canvas. *Please do not come to class if you have symptoms.* If you test positive for COVID, please follow the guidance at <https://www.clemson.edu/covid->

19/medical-guidance/positive-test.html and complete the Notification of Absence form on this website to notify your instructors. Please note that filling out this form does not constitute a medically excused absence. Course accommodations for students in these situations will be made on a case-by-case basis.

COURSE OUTLINE

Date	Topic	Reading	Assignments Due
13 Jan. (Th)	Introduction and critical thinking overview		
18 Jan. (T)	Inorganic chemistry review	Chapters 1 & 2	
20 Jan. (Th)	Inorganic chemistry review		
25 Jan. (T)	Biochemistry review	Chapter 3	Problem set 1
27 Jan. (Th)	Biochemistry review		
1 Feb. (T)	Physical methods and timescales	Chapter 4	Problem set 2
3 Feb. (Th)	Physical methods		
8 Feb. (T)	Critical thinking: Why and how?		Problem set 3
10 Feb. (Th)	Metal deficiency and excess	Chapter 5	
15 Feb. (T)	Metal uptake / transport / storage		
17 Feb. (Th)	Metal uptake / transport / storage	Chapter 6	
22 Feb. (T)	Metal uptake / transport / storage		Problem set 4
24 Feb. (Th)	Metal uptake / transport / storage	Chapter 7.1, 8.1, 8.2	
1 Mar. (T)	Review		
3 Mar. (Th)	MIDTERM EXAM		
8 Mar. (T)	Metals in proteins	Chapter 9	
10 Mar. (Th)	Metals in proteins	Chapter 10	
15 Mar. (T)	Metals in proteins		Problem set 5
17 Mar. (Th)	Metals in proteins	Chapter 11	Paper outline approved
21-25 Mar.	Spring break		
29 Mar. (T)	Metals in proteins	Chapter 12	
31 Mar. (Th)	Metals and nucleic acids	Chapter 7.2-7.4, Outside reading	Problem set 6
5 Apr. (T)	Metals and nucleic acids	Chapter 8.3-8.4	Paper due for review
7 Apr. (Th)	Metals in nucleic acids		
12 Apr. (T)	Metal toxicity	Outside reading	Problem set 7
14 Apr. (Th)	Metal toxicity		
19 Apr. (T)	Lanthanide enzymes		Peer review due
21 Apr. (Th)	Metals in medicine	Chapter 13	
26 Apr. (T)	Metals in medicine		Problem set 8
28 Apr. (Th)	Review		Revised paper due
4 May (W)	FINAL EXAM 8:00 – 10:30 am (158 Hunter)		