CHEM:5205:0001-Bioinorganic Chemistry  
Fall 2015  
Tuesdays and Thursdays, 3:30 PM – 5:15 PM; W55 CB

INSTRUCTOR  
Professor Mishtu Dey. mishtu-dey@uiowa.edu  
Office: W285 CB; Tel. 4-1319  
Office hours: 9:00-10:30 AM (T) and 2:00-3:30 PM (Th), or by appointment

Course Website https://icon.uiowa.edu

OBJECTIVE. The Purpose of this course is to give a survey of the pertinent topics of modern biological inorganic chemistry. This is not intended to be an all-encompassing survey, as the multi-disciplinary nature of the field prevents that; nor is it intended to be a series of ‘hot topics’. It is my hope that by the end of the course, students will have: (a) a detailed appreciation of the field, and the familiar themes that can be found in bioinorganic systems, (b) a tool box of methods that should be useful to study any catalytic system; (c) a deeper understanding of designing experiments relevant to any bioinorganic systems (metalloenzymes or model complexes); and (d) a set of skills that allow each student to critically evaluate primary scientific literature.

GRADING. The grade for this course will be determined by one 100 pt. exam (40%), a written research paper with oral presentation (100 pt., 30%), four problem sets (15%), 4 homeworks (10 %) plus quiz (5%).

• Critical review of a research topic followed by class presentation: Each student will critically review a literature paper on a chosen metalloprotein approved by the instructor. An abstract that each student submits will include background, brief statement of results, conclusions from a recent literature paper, and a creative component where the student will outline a follow up experiment(s). Metalloprotein will be selected by student and approved by the instructor. The class presentations will be in journal club style that is short (15 min, with 5 min of discussion). Written abstracts for the research paper are due by thanksgiving break. There will be no final examination.

• Problem Set and Homework: Problems are due at the lecture designated in the syllabus below.

• Exam: There will be one exam, which is typically held sometime in November, before thanksgiving). Time, date, and place for the exam will be arranged in class to accommodate student schedules. Exams will consist mostly of material covered in the class and related review articles, and recommended texts. A sizeable block of time is generally needed for each exam, so they are usually held in the evenings.

RECOMMENDED TEXTS. No specific textbook is required for the class, although two books are recommended as options to consider as useful reference materials.


This will be supplemented with literature reviews and primary literature articles; key reference texts are listed at the end of this Syllabus.
**Instructions on Critical review of a research topic: (100 pts)**

Choose one metalloprotein and get it approved by the instructor. Use primary literature and research your metalloprotein. Submit an abstract. Prepare a 15 minute power point presentation on your metalloprotein. The presentation will be turned into the instructors and presented to the class during December. Please include all of the following information as a minimum:

1) Include the protein name and all metal ions utilized.
2) List the names and the institutions of main researchers working on the metalloprotein.
3) Name the common biological sources of the metalloprotein.
4) What are other related proteins? Is the protein a member of a larger family?
5) List the ligands and active site geometry.
6) Is there a crystal structure available? What is its PDB ID? (www.rcsb.org)
7) Describe the metalloprotein’s function and show its reaction mechanism. If multiple mechanisms are debated, please discuss.
8) Name the key spectroscopies used to characterize the metal site and present the conclusions drawn from the data. Show pictures of the spectra from the paper.
9) Find examples of synthetic model compounds of the metalloprotein site. Show their structure. Is it a structural model, functional model, or both? What insights into the native protein were learned from the model?
10) Provide at least one separate literature reference for each piece of information above. Use primary literature sources only.

Note: Internet citations, such as wikipedia, google, etc., or citation of class textbooks will not be accepted.
## TENTATIVE SYLLABUS and COURSE INFORMATION

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Dates</th>
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<th>Book Chapters</th>
<th>Assignment Due</th>
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<tr>
<td>1</td>
<td>8/25 (T)</td>
<td>Introduction: A review of Metals in Biology, Medicine and Biogeochemical Cycles</td>
<td>Lippard, Ch. 1, 2, 7; Bertini Ch. II, VII</td>
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<td></td>
<td>8/27 (Th)</td>
<td>Introduction to Biochemistry &amp; Metal Ions and Proteins: Binding, Stability, and folding</td>
<td>Bertini Tutorial I, p.657, and Ch. III</td>
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<td>2</td>
<td>9/1 (T)</td>
<td>Introduction to Inorganic Chemistry</td>
<td>Bertini Tutorial II, p. 695, Lippard Ch. 3</td>
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<td>9/3 (Th)</td>
<td>Physical Methods in Bioinorganic Chemistry (Common Spectroscopic Techniques)</td>
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<td>3</td>
<td>9/8 (T)</td>
<td>Special Cofactors and Metal clusters</td>
<td>Bertini Ch. IV, IX.3, Bertini Ch. V, VIII</td>
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<td>Metal Ion Transport and Storage</td>
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<td>Heme Fe – O₂ Carriers (Myoglobin, Hemoglobin)</td>
<td>Bertini Ch. XI.4, Lippard Ch. 11</td>
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<td>9/17 (Th)</td>
<td>O₂ Activation (Hr, Hc, P450)</td>
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<td>5</td>
<td>9/22 (T)</td>
<td>Non-Heme Fe – O₂ Activation</td>
<td>Bertini Ch. XI.5, Bertini XI.6, XI.7</td>
<td>PS # 2 (T)</td>
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<td>9/24 (Th)</td>
<td>O₂ Reduction – Cytochrome c Oxidase</td>
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<td>6</td>
<td>9/29 (T)</td>
<td>O₂ Evolution – Photosystem II</td>
<td>Bertini Ch. X, XI</td>
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<td>10/1 (Th)</td>
<td>O₂ toxicity – SOD, Catalase, Peroxidase</td>
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<td>7</td>
<td>10/6 (T)</td>
<td>Hydrogen metabolism and Hydrogenase</td>
<td>Bertini Ch. XII.1, Ch.XII.2, Lippard Ch. 11</td>
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<td>10/8 (Th)</td>
<td>Metalloenzymes with Radical Intermediates (Cobalamins, Fe-S clusters and S-adenosyl methionine)</td>
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<td>8</td>
<td>10/13 (T)</td>
<td>O₂ activation and Nitrogenase</td>
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<td>Metalloenzymes with Radical Intermediates (Cobalamins, Fe-S clusters and S-adenosyl methionine)</td>
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<td>Metal-dependent Lyase and Hydrolase</td>
<td>Bertini Ch. IX</td>
<td>PS # 4 (T)</td>
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<td>Biological Nitrogen Fixation and Nitrogenase</td>
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<td>11/19 (Th)</td>
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**CHEM:5205 Bioinorganic Chemistry Syllabus**

Fall 2015
Some suggested resource reading:

In addition to the recommended texts and the references cited therein, many useful articles can supplement the course materials. A helpful list of selections of the review literature is given below. Other primary sources (research) articles will be distributed.

Recent bioinorganic thematic issues:
Chemical Reviews 2009, 109 (10), 4553-4960: Cellular Metal Homeostasis and Trafficking Special Issue.

Additional Reference texts:

Additional Information about Collegiate Policies and Procedures
The following policy and procedural statements have been summarized from the web pages of the College of Liberal Arts and Sciences and The University of Iowa Operations Manual.

Administrative Home
The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Student Academic Handbook.

Electronic Communication
University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences. (Operations Manual, III.15.2. Scroll down to k.11.)
Accommodations for Disabilities
A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See www.uiowa.edu/~sds/ for more information.

Academic Honesty
The College of Liberal Arts and Sciences expects all students to do their own work, as stated in the CLAS Code of Academic Honesty. Instructors fail any assignment that shows evidence of plagiarism or other forms of cheating, also reporting the student's name to the College. A student reported to the College for cheating is placed on disciplinary probation; a student reported twice is suspended or expelled.

CLAS Final Examination Policies
Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

Making a Suggestion or a Complaint
Students with a suggestion or complaint should first visit the instructor, then the course supervisor, and then the departmental DEO. Complaints must be made within six months of the incident. See the CLAS Student Academic Handbook.

Understanding Sexual Harassment
Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather
In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety web site.

The Chemical Professional’s Code of Conduct
American Chemical Society

Chemical Professionals Acknowledge Their Responsibilities

To the Public

Chemical professionals have a responsibility to serve the public interest and safety and to further advance the knowledge of science. They should actively be concerned with the health and safety of co-workers, consumers and the community. Public comments on scientific matters should be made with care and accuracy, without unsubstantiated, exaggerated, or premature statements.

To the Science of Chemistry
Chemical professionals should seek to advance chemical science, understand the limitations of their knowledge, and respect the truth. They should ensure that their scientific contributions, and those of their collaborators, are thorough, accurate, and unbiased in design, implementation, and presentation.

To the Profession

Chemical professionals should strive to remain current with developments in their field, share ideas and information, keep accurate and complete laboratory records, maintain integrity in all conduct and publications, and give due credit to the contributions of others. Conflicts of interest and scientific misconduct, such as fabrication, falsification, and plagiarism, are incompatible with this Code.

To Their Employer

Chemical professionals should promote and protect the legitimate interests of their employers, perform work honestly and competently, fulfill obligations, and safeguard proprietary and confidential business information.

To Their Employees

Chemical professionals, as employers, should treat subordinates with respect for their professionalism and concern for their well-being, without bias. Employers should provide them with a safe, congenial working environment, fair compensation, opportunities for advancement, and proper acknowledgment of their scientific contributions.

To Students

Chemical professionals should regard the tutelage of students as a trust conferred by society for the promotion of the students’ learning and professional development. Each student should be treated fairly, respectfully, and without exploitation.

To Associates

Chemical professionals should treat associates with respect, regardless of the level of their formal education, encourage them, learn with them, share ideas honestly, and give credit for their contributions.

To Their Clients

Chemical professionals should serve clients faithfully and incorruptibly, respect confidentiality, advise honestly, and charge fairly.

To the Environment

Chemical professionals should strive to understand and anticipate the environmental consequences of their work. They have a responsibility to minimize pollution and to protect the environment.