Chemistry 3000

Metals in Biology
Winter Semester 2009
8:30–9:25 a.m. MWF
0143 Old Main

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TENTATIVE LECTURE SCHEDULE (EXAM DATES ARE FIRM)

DATES	SUBJECT	Shriver CH	Lippard CH	HW
Jan 12, 14, 16	Intro to Metals in Biology, inorganic chemistry basics (electronic configuration, nomenclature, Lewis structures, VSEPR, etc.)	1, 2		
Jan 21, 23	Valence bond theory and molecular orbital theory for small molecules	2		H1 due 1/30
Jan 26, 28, 30	Coordination chemistry fundamentals (ligands, geometries, hard–soft concept, chelate and macrocyclic effects, electron counting, etc.)	8, 20	2	
Feb 2, 4, 6	Crystal field theory	19		H2 in class 2/6
Feb 9, 11	Proteins and nucleic acids		3	
Feb 13	**FIRST EXAM**			
Feb 16, 18, 20	Choice and delivery of metal ions		5, 6	
Feb 23, 25, 27	Metal structure and activity in biomolecules		7, 8	
Mar 2, 4, 6	Electron-transfer		9	H3 due 3/13
Mar 9, 11, 13	Atom- and group-transfer chemistry		11	
Mar 16-21	**SPRING BREAK**			
Mar 23, 25	Metals in therapeutic medicine			
Mar 27	**SECOND EXAM**			
Mar 30, Apr 1, 3	Metals in diagnostic medicine			H4 due 4/10
Apr 6, 8, 10	Current topics presentations			
Apr 13, 15, 17	Current topics presentations			
Apr 20, 22, 24	Current topics presentations			
Apr 27	Catch-up and review			
Apr 29	**COMPREHENSIVE FINAL EXAM, 8:00-10:30 a.m. 0143 Old Main**			

REQUIRED TEXTS: Select chapters from Shriver & Atkins "Inorganic Chemistry" 4th Edition in the form of a course packet are available from www.universityreaders.com for $39.17. Additionally, Stephen J. Lippard & Jeremy M. Berg "Principles of Bioinorganic Chemistry" is available at the bookstore, but may be less expensive on-line. These texts are also on reserve at the Science and Engineering Library. Current topic papers can be downloaded via a link on the blackboard course webpage.

OFFICE HOURS: Monday 9:30–10:30 a.m., Wednesday 3:00–4:00 p.m., *or by appointment*.

PREREQUISITE: CHM 1240 or equivalent.

COMMUNICATION: E-mail correspondence sent to Professor Allen must contain "CHM 3000" in the subject line.

COURSE WEBPAGE: There is a webpage for this course on blackboard: http://blackboard.wayne.edu/. Announcements, grades, copies of homework and exercises, answer keys, and supplemental information will be provided. New users to blackboard can visit the computing and information page at http://computing.wayne.edu/blackboard/aboutblackboard.php for more information about access and use of blackboard.

GRADING: The hour exams (2) are each worth 100 points. The Final exam is worth 200 points. There will be 4 homework assignments worth 25 points each for a total of 100 points. The current topic presentation will be worth 100 points (60 points for your presentation and 40 points for participating in class discussions following other presentations).

The equivalent of a one hour exam (the lowest exam or half of the final exam) will be dropped, and the final grade will be determined on the remaining 500 points. **As a result, no make-up exams will be given.** I will give an approximate grade breakdown for each exam so that you have an idea where you stand at any time. However, *these grades are only approximate*.

Final grades will not be assigned tougher than the following scale:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
≥93%	≥90%	≥87%	≥83%	≥80%	≥77%	≥73%	≥70%	≥67%	≥60%	≥55%	<55%

Request for regrades will result in the *entire* assignment or exam being regraded, which could result in an increase, decrease, or no change in the overall score.

ATTENDANCE: I encourage all students to attend every class. I often stress points in class that show up on exams. Students are responsible for obtaining notes from missed lectures from classmates, they will not be provided by the course instructor, nor will the instructor take significant time to explain material during office hours that the student has not received due to a missed lecture. As emphasized above, no make-up exams will be given, so attendance at exams is mandatory. Additionally, one of the homework sets will be done in groups IN CLASS on February 6; attendance at this class is mandatory.

COURSE DROPPING: *February 23* is the last day that requests for drops will be accepted. Please see: http://sdcl.wayne.edu/RegistrarWeb/Registrar/policies.htm for instructions on requesting drops.

DISSABILITIES: If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The SDS office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TTY: telecommunication device for the deaf; phone for hearing impaired students only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University

CURRENT TOPIC PRESENTATION: Topics (and groups depending on the size of the class) will be assigned sometime during the first two weeks of class. Presenters are required to meet with Professor Allen **at least** one week prior to their presentation. Bring your presentation and discussion questions to the meeting for critique by Professor Allen. It is your responsibility to schedule this meeting well in advance; if you wait until the night before your desired meeting date to schedule, I might not be able to accommodate your request.

All participants assigned specific topic must contribute to the seminar presentations of the day. Everyone in the class is expected to be prepared to answer the discussion questions. The questions for discussion must be emailed to all course participants by 4 p.m. on the Friday afternoon preceding the seminar so that everyone has time to think about them.

The following guidelines should facilitate preparation of the presentations.

1. **Introduction (5–10 minutes**). Summarize briefly the important facts and history needed for an intelligent listener who is not an expert to place the paper in proper context. Typically, the introduction should outline what unsolved issue(s) are being addressed, why the particular approach is being used, and how this approach differs from previous work on the system.

2. **Critical discussion of methods and results (20 minutes).** Provide an overview of the methods so that listeners can follow the experiments. For example: "Proteins were separated by SDS-PAGE." Not: "Five micrograms of protein were dissolved in 0.1 mL of 1% (w/v) SDS, containing 1 mM β-mercaptoethanol". Whenever possible use a figure to summarize the experimental protocols and results. Point out the critical steps and show the kind of data obtained.

   In discussing results, show the original data. This can be done by importing the figure directly from a PDF using Adobe Acrobat. It is helpful to put a title on each slide that summarizes the question being asked in the experiment or the experimental result. If the original data involves a complex figure with many curves, label the curves so that the audience need not read the legend to get the information. If specific comparisons within a Table are most important, facilitate those comparisons by color-coding the numbers that should be compared with each other.

   If a Figure or Table that you are focusing on leads to a clear conclusion, state it at the bottom of the transparency. If you think of other interpretations of the data, you should raise these issues.

3. **Class Discussion (15 minutes).** On a slide, each student presenting should pose 1–2 questions to be answered by small groups of students working together in class. The question(s) should address an important issue in the article and provoke discussion within the groups.

4. **Recapitulation (5–10 minutes).** Summarize the major experimental results, the authors' conclusions and your assessment of their conclusions.

The formal part of the seminar should be a critical discussion of no more than 30 minutes. Sometimes students discover that they are using much more time than they had anticipated. To avoid this problem, practice your talk. Be sure to allow the time for questions and discussion.

Common Mistakes in Seminars

1. **Inadequate introduction** —You must give enough background so that the intelligent listener will know why the work you describe was done, and how the problem was approached experimentally. Do not waste time in introducing too much background: tell your audience what they need to know to understand the paper you are presenting—no more, no less.

2. **Failure to provide the rationale behind a specific experiment**—Before you plunge into a description of a specific experiment, tell the audience why it was done. An effective approach is to say: "the authors next asked, is ATP required for the phosphorylation of glucose? In this experiments, glucose was incubated with and without ATP, and the concentration of the product, glucose-6-phosphate was measured…." This sounds obvious, but it is the most common mistake in seminars and one that is easy to correct. *State the question before describing the answer.*

3. **Poor description of experimental results**—When you show a figure or table, immediately point out what is being measured and state what each axis represents; say explicitly what each column in a table represents. Use the pointer to guide your audience.

4. **Too much information on your slides**—For written slides (as opposed to data slides or graphics slides) write no more than 5–7 lines per slide. You need not write complete sentences; key phrases are adequate. Remember, your slides are visual aids; you do not want your audience focusing its attention on the slides at the expense of listening to you.

5. **Incorrect pace**—Speakers often try to show their absolute mastery of the subject matter by discussing it at high speed. This approach is counter-productive; your listener will stop trying to understand and everyone's time is wasted. If you must err in pacing, err in the direction of going a little too slowly. Do not worry about pausing and not speaking for a few moments. Such pauses allow your audience to process the information and perhaps break in with discussion or questions. If some points are more important than others, it may be worth modulating your tone of voice and/or summarizing these key points during particular stages of the seminar.

6. **Advocacy of authors**—You are under no obligation to defend the authors' conclusions; you did not write the paper. Present the data as objectively as you can. State the authors' conclusions, and state your own reservations or conclusions. The idea is read the paper critically, and you should treat the paper as if you were a referee, not a member of the authors' laboratory. Although you should be critical when appropriate, you also should be mindful of the fact that the authors are not present to rebut your criticisms.

7. **Distracting mannerisms**—When you use a pointer, point at the information you want to highlight (you need not lasso it or emphatically underline it). Turn the pointer off when you are not using it to make a point, and please do not aim it at the audience. Speak to your audience, not the screen. Try to make eye contact with the audience. Speak LOUDLY.

8. **Vague discussion questions** —Make sure that your discussion questions address interesting and important issues that can be discussed. It is probably best if you do not have an "answer" in mind, but ask about an issue that is left unresolved or can be seen from different views. Make sure that your questions are worded clearly.

POTENTIAL CURRENT TOPIC PRESENTATIONS:

1. Jacobsen, F. E.; Lewis, J. A.; Cohen, S. M. The Design of Inhibitors for Medicinally Relevant Metalloproteins. *ChemMedChem* **2007**, *2*, 152–171.
2. Hu, Y.; Fay, A. W.; Lee, C. C.; Yoshizawa, J.; Ribbe, M. W. Assembly of Nitrogenase MoFe Protein. *Biochemistry* **2008**, *47*, 3973–3981.
3. Parkin, G. Applications of Tripodal [S_3] and [Se_3] L_2X Donor Ligands to Zinc, Cadmium and Mercury Chemistry: Organometallic and Bioinorganic Perspectives. *New J. Chem*. **2007**, *31*, 1996–2014.
4. Roth, J. P. Advances in Studying Bioinorganic Reaction Mechanisms: Isotopic Probes of Activated Oxygen Intermediates in Metalloenzymes. *Curr. Opin. Chem. Biol*. **2007**, *11*, 142–150.
5. Quintanar, L. Manganese Neurotoxicity: A Bioinorganic Chemist's Perspective. *Inorg. Chim. Acta* **2008**, *361*, 875–884.
6. Chen, P.; Andoy, N. M. Single-molecule Fluorescence Studies from a Bioinorganic Perspective. *Inorg. Chim. Acta* **2008**, *361*, 809–819.
7. Bertini, I.; Cavallaro, G. Metals in the "Omics" World: Copper Homeostasis and Cytochrome c Oxidase Assembly in a New Light. *J. Biol. Inorg. Chem*. **2008**, *13*, 3–14.
8. Ueno, T.; Abe, S.; Yokoi, N.; Wantanabe, Y. Coordination Design of Artificial Metalloproteins Utilizing Protein Vacant Space. *Coord. Chem. Rev*. **2007**, *251*, 2717–2731.
9. Liang, X.; Campopiano, D. J.; Sadler, P. J. Metals in Membranes. *Chem. Soc. Rev*. **2007**, *36*, 968–992.
10. Ge, R.; Sun, H. Bioinorganic Chemistry of Bismuth and Antimony: Target Sites of Metallodrugs. *Acc. Chem. Res*. **2007**, *40*, 267–274.
11. Forano, C.; Prevot, V. Enzyme-based Bioinorganic Materials. In *Bio-inorganic Hybrid Nanomaterials*; Ruiz-Hitzky, E., Ariga, K., Lvov, Y. M., Eds.; Wiley-VCH: Weinheim, 2008; pp 443–484.
12. Zannoni, D.; Borsetti, F.; Harrison, J. J.; Turner, R. J. The Bacterial Response to the Chalcogen Metalloids Se and Te. *Adv. Microb. Physiol*. **2008**, *53*, 1–71.
13. Que, E. L.; Domaille, D. W.; Chang, C. J. Metals in Neurobiology: Probing Their Chemistry and Biology with Molecular Imaging. *Chem. Rev.* **2008**, *108*, 1517–1549.