

**METALLOBIOCHEMISTRY****MBMB 533 (Advanced Biochemistry)****Eric C. Niederhoffer, Ph.D.**

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GENERAL INFORMATION:

Metallobiochemistry (MBMB 533, three credit hours) is intended to provide you with a foundation in modern inorganic biochemistry with specific emphasis on metal-containing proteins. We will draw upon knowledge of biochemistry, cell biology, and chemistry to understand some recent scientific problems. You should be familiar with the Internet and either PC or Mac computers. Classes meet on Monday and Wednesday afternoons for 75 minute sessions, unless otherwise specified.

**I reserve the right to change or modify the syllabus.**

RESOURCES:

We will use the following textbook and selected articles from the current literature:

**Cowan, J. A.** 1997. Inorganic biochemistry: an introduction, 2nd ed. John Wiley & Sons, Inc., New York.

You may find it useful to review fundamental concepts as outlined in any of the recent biochemistry and inorganic textbooks, including:

**Voet, D., J. G. Voet, and C. W. Pratt.** 1999. Fundamentals of biochemistry, John Wiley & Sons, Inc., New York. An upgrade edition of this should soon be available.

**Cotton, F. A., G. Wilkinson, C. A. Murillo, and M. Bochmann.** 1999. Advanced inorganic chemistry, 6th ed. John Wiley & Sons, Inc., New York.

We will use the molecular viewing applications Protein Explorer, RasMol and Swiss-PdbViewer during this course. See "Chime Square" for additional information concerning macromolecular viewing of protein and nucleic acid structures.

COURSE WEB SITE:

[http://www.siu.edu/departments/biochem/bmb\\_courses/mbmb\\_533\\_syllabus.html](http://www.siu.edu/departments/biochem/bmb_courses/mbmb_533_syllabus.html)

GRADING POLICY:

Your performance in this course will be based on a combination of examinations and problem sets. Examination and problem set dates will be announced in class and posted to the course web site. **I reserve the right to change the date of examinations and problem sets.**

**There will be no make-up examinations or problem sets. A valid signed University-approved or medical excuse must be presented to me as soon as possible if you miss**

**an examination.** In general, only medical emergencies are considered legitimate excuses. One examination performance may be offset by the average of your second lowest examination score and the final examination score.

#### TENTATIVE COURSE OUTLINE:

##### Fundamentals of inorganic biochemistry **4 discussions**

The elements; formal oxidation states and coordination geometries; classification of metal ions and ligands (HSAB theory); stability constants; stabilization of oxidation states; ligand field stabilization energy; kinetics and mechanisms of reactions involving metal complexes; electron-transfer reactions; reaction kinetics and thermodynamics; biological ligands

##### Experimental methods **4 discussions**

Introduction to spectroscopy; optical spectroscopy; magnetic resonance and related disciplines; solution methods dependent on X-radiation and  $\gamma$ -radiation; electrochemical methods; enzyme kinetics; measuring the molecular mass of a protein; measurement of macromolecule-ligand binding affinities

#### **First Examination - Fundamentals and experimental methods**

##### Transport and storage **4 discussions**

Metal ion uptake and transmembrane ion transport, siderophores; transport and storage of metal ions in vivo, transferrin, ferritin, metallothionein

##### Metalloproteins and metalloenzymes: (I) oxygen carriers and hydrolases **4 discussions**

Oxygen carriers, myoglobin, hemoglobin, hemerythrin, hemocyanin; hydrolase enzymes, carboxypeptidase A, alkaline phosphatase, purple acid phosphatase, arginase, urease; hydro-lase enzymes, aconitase

#### **Second Examination - Transport & storage and metalloproteins & metalloenzymes**

##### Metalloproteins and metalloenzymes: (II) redox chemistry **6 discussions**

Prosthetic centers, cofactors, and coenzymes; protein-protein electron transfer

##### Cell toxicity **4 discussions**

Oxygen toxicity, superoxide dismutase; metal toxicity

#### **Third Examination - Metalloproteins & metalloenzymes and cell toxicity**

##### Case studies **6 discussions**

Carbon monoxide dehydrogenase/acetyl-coenzyme A synthase; cytochrome c oxidase; nitrogenase

#### **Final Examination - Selected Semester topics**