

# Metals in Biology

BMB 961-001, MMG 803-001, & CMB 800-002

2 credits

Spring 2025

**Instructors:** Bob Hausinger                      Eric Hegg                      Guest  
6193 BPS    510 Biochemistry                      Instructors  
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**Lectures:** Tu and Th, 9:10 a.m. to 10:00 a.m., 502 Biochemistry

**Office Hours:** By appointment

**Text:** A significant portion of the reading will come from journal articles. All primary and secondary articles will be available online via D2L.

Short readings may also be assigned from a variety of texts and made available via D2L, but no book is required.

**Topics:** Metals in biogeochemical cycles  
Electron transfer  
Metal-dependent hydrolases  
Metal toxicity  
Calcium biochemistry  
Biochemistry of nickel  
Fe/Cu/Ni/Zn sensing, transport, and storage  
O<sub>2</sub> activation by heme and non-heme sites  
Medical aspects of metals  
O<sub>2</sub>-production by the Mn cluster in photosystem II  
Nitrogen cycle  
Metal regulation/homeostasis  
Metal cofactor biogenesis  
Metals in energy transduction

**Grading:** Grades will be based on student presentations, class participation, and possibly a written quiz (take-home problem set)

**Course objective:** Metals in Biology is intended for graduate students with backgrounds in biochemistry, molecular/cellular/plant biology, microbiology, and/or chemistry. In this course we will discuss the roles of metals in biological systems, including metalloenzymes, metallocenter biosynthesis, metal transport, metal toxicity, and metalloregulation. Discussions will focus on the catalytic mechanisms as well as the way in which the different protein environments “tune” their active site. Student presentations will be an important emphasis in this class.

Contact Bob Hausinger with any questions.

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9:10-10 am Tuesdays and Thursdays; 502 Biochemistry

date	presenter	topic
<b>Introduction</b>		
14-Jan	Hausinger	Class Overview/Key Biological & Chemical Concepts
<b>Medical Aspects of Metals</b>		
16-Jan	Hausinger	Metals in Medicine: cis-Platinum
21-Jan	Hammer	Nutritional Immunity: Metals at the Host-Pathogen Interface
23-Jan	LaPres	Cobalt Biology and Toxicity
28-Jan	Hausinger	Nickel Toxicity in Humans (and Microbes)
<b>Metal Sites in Proteins</b>		
30-Jan	Hausinger	Calcium Biochemistry and the EF-Hand Motif
4-Feb	Hegg	Iron-Sulfur (FeS) Clusters (and primer on cyclic voltammetry and EPR/Mössbauer)
6-Feb	Hegg	Blue Copper Proteins, the Dicopper Cu <sub>A</sub> Site, & Electron Bifurcation (and primer on EPR)
11-Feb	Hegg	Peroxidases and the Cytochromes P450 (and primer on resonance Raman)
no classes on 2/13/2025		
18-Feb	Hausinger	Non-Heme Iron Enzymes
20-Feb	Hegg	Cytochrome c Oxidase
25-Feb	Hegg	Denitrification
27-Feb	Hausinger	Nitrogenase
3/2-3/9 Spring Break		
11-Mar	Hegg	Oxygen-Evolving Complex (OEC) in Photosystem II
13-Mar	Hausinger	Metallocenters in hydrolases
18-Mar	Warren	Biomimetic metallocenters
<b>Other Topics</b>		
20-Mar	Andorfer	Directed Evolution of Metalloenzymes
25-Mar	O'Halloran	Quantitation and Visualization of Metals in Cells
27-Mar	O'Halloran	Molecular Mechanisms of Cellular Metal Regulation and Trafficking
1-Apr	Hu	Zinc Transporters
3-Apr	Hausinger	Nickel Metallocenter Assembly
8-Apr	Hegg	Metalloenzymology of Biogeochemical Cycles
10-Apr	student talk(s)	
15-Apr	student talk(s)	
17-Apr	student talk(s)	
22-Apr	student talk(s)	
24-Apr	student talk(s)	
exam time	student talk(s)	
exam time	student talk(s)	