**Chem 190: Bioinorganic Chemistry**

**Spring 2021**

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| **Professor**  Kathy Van Heuvelen  vanheuvelen@g.hmc.edu | **Class (Zoom links on Sakai)**  T Th  6:00 pm – 7:15 pm (Pacific Time) |
| **Drop-By Office Hours**  Set after polling the class; will be posted on Sakai  Zoom link on Sakai  *This is a time when all students are welcome and encouraged to drop in and ask questions, no appointment needed.* | **Course Website**  We will use the class Sakai ***HMC Chemistry 190 SP21*** site to post course materials and Zoom links.  All coursework will be submitted to Gradescope. |
| **Available for Individual Appointments**  Email Prof. Van and suggest three dates and times that work for you.  Talking with students is a joy, so never hesitate to reach out! | |

**Why Chem 190?**

Metals in biological systems can perform a wide range of reactions with exquisite efficiency and selectivity. In contrast, performing many of the same reactions in the lab requires harsh conditions and/or rare, expensive materials. In addition to their role in reactivity, metals in biological systems serve important roles in protein structure, electron transport, signaling, biological mineralization, and a host of other functions. In this class, we will investigate how metals support aerobic respiration, how metals provide us with food and fuel, and how metals in medicine facilitate healing through therapeutic and diagnostic applications.

This course seeks to take a holistic approach by connecting bioinorganic chemistry to three fundamental human needs: breath, nourishment, and healing. The first unit, **Breath**, follows the production of oxygen by Photosystem II, electron transfer in blue copper proteins, the transport of oxygen by hemoglobin, and aerobic respiration using cytochrome C oxidase. The second unit, **Nourishment**, looks at bioinorganic chemistry that sustains us through food and fuel. In gen chem, we learned about the Haber-Bosch process that feeds half the world. In Chem 190, we will learn about the nitrogenase enzyme that produces enough fertilizer to feed the other half. We will also discuss the hydrogenase enzyme and how it produces the fuel hydrogen. The third unit, **Healing**, looks at the roles of metals in diagnosis and in therapeutics.

**KEY INFORMATION ABOUT THE COURSE**

The world is struggling with the COVID-19 pandemic, which affects all of us in different ways including increased stress and anxiety, economic hardships, illness, and isolation from loved ones. I am here to support you, and I expect that all of us will need some grace as HMC operates remotely. Class policies are designed to provide you with some flexibility (for example, your lowest homework score is dropped). I am also happy to work with you individually when you encounter challenges. Even as this semester presents challenges for us all, your presence in this class indicates a belief in a better future.

**Life Happens Policy**

Life happens to all of us (minor illness, injury, family emergencies). Each student receives one free pass in this class, which entitles you to a no-questions-asked 24-hour extension. You can use this free pass at any time during the semester for any assignment unless explicitly noted otherwise on the assignment instruction sheet.

This policy is for all students. It is in addition to individual accommodations that you may receive through the ADA office (see later in this syllabus).

Any student who encounters long-term difficulties, such as a severe illness or life event that disrupts your ability to work for multiple days, should contact the Associate Dean of Academic Resources and Student Success, Amy Bibbens, via email [abibbens@hmc.edu](mailto:abibbens@hmc.edu).

**Required Texts and Materials:**

We will use the textbook *Metals and Life* edited by Eleanor Crabb and Elaine Moore.

Additional readings will be posted on the course Sakai page.

We will use Zoom for class sessions and office hours. All assignments will be available to you through Sakai, and you will submit work to Gradescope (www.gradescope.com).

**Learning Objectives**:

Upon successful completion of this course, students will be able to:

Overarching

* Read a scientific article and report the main findings
* Search the chemical literature using a database such as SciFinder or Web of Science
* Describe the role of metal centers in oxygen generation and aerobic respiration
* Compare and contrast nitrogen and hydrogen generation in biological systems and in society
* Explain how metals are used medicinally in therapeutic and diagnostic applications

Detailed learning objectives for each unit will be posted on Sakai.

[*This section is adapted from Lang, James. On Course: A Week-by-Week Guide to Your First Semester of College Teaching. Cambridge: Harvard University Press, 2008]*

**Student Responsibilities**: You will receive the greatest benefits from this course if you commit to the following:

* **Be attentive**. Cell phones should be silenced and outside messengers closed. In order to support our class community, I ask that you use class time to fully engage with chemistry. Please refrain from using social media or working on any other activities that do not pertain to Chem 190 during class time. Zoom fatigue is real; if you need a break, do turn off your video and stretch for a minute. But I ask that you keep any necessary breaks brief and return to class ready to engage.
* **Engage actively with the course**. Many of the benefits from this class come from participation in class activities, and active participation is expected and required. Active participation takes many forms beyond simply attending and speaking in class. Active participation can include asking questions of your professor or classmates in class and/or office hours, participating synchronously on Zoom during scheduled class times, participating in asynchronous conversations, engaging with your classmates in breakout rooms by asking or answering questions, listening and taking notes, and writing down questions to ask during office hours. I recognize that studying remotely in distant time zones and the inherent uncertainty of pandemic life may prevent you from attending every Zoom class. Please reach out to me when you have difficulties attending class.

**Instructor Responsibilities**

* **Be responsive**. You will have the opportunity to provide regular feedback on assignments. I will listen to your concerns regarding the content and pacing of the course and will respond accordingly. I will strive to respond to emails within 48 hours Monday-Friday and will ensure that requests for individual meetings are met as quickly as my schedule allow.
* **Be Respectful and Fair**. I will do my best to maintain a fun and inclusive learning environment. I will ensure that all students have the opportunity to speak in class.

***TENTATIVE CHEM 190 COURSE CALENDAR (all times Pacific Time Zone)***

See Sakai for updated readings

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| Class | Day | Date | Topic | Reading due by class time\* |
| 1 | T | 1/26 | First day of class ☺ |  |
| 2 | Th | 1/28 | Chemistry for Biologists, Biology for Chemists | M&L 1.1-1.5, 2.1-2.1.6 |
| 3 | T | 2/2 | **Breath**: O2 transport in humans: myoglobin and hemoglobin | M&L 8.1.3-8.1.8 |
| 4 | Th | 2/4 | Blue copper proteins | M&L 7.4 intro, 7.4.3, 7.4.4 |
| 5 | T | 2/9 | Cytochrome C Oxidase | M&L 8.2-8.2.2 |
| 6 | Th | 2/11 | Oxygen Evolving Complex | M&L 8.3-8.3.5 |
| 7 | T | 2/16 | **Nourishmen**t: N2 Fixation | M&L 8.4-8.4.5 |
| 8 | Th | 2/18 | Hydrogenase | Posted on Sakai |
| 9 | T | 2/23 | **Healing**: Metals and Medicine | Posted on Sakai |
| 10 | Th | 2/25 | Metals and Medicine | Posted on Sakai |
| 11 | T | 3/2 | Literature Discussion | Posted on Sakai |
| 12 | Th | 3/4 | Literature Discussion | Posted on Sakai |
| 13 | T | 3/16 | TBA |  |
| 14 | Th | 3/18 | Present projects ☺ ; last day of class ☹ |  |

\*M&L = *Metals and Life*, ed. Eleanor Crabb and Elaine Moore

**KEY INFORMATION ABOUT STUDENT SUCCESS AND RESOURCES**

**Our Mission Statement:** Harvey Mudd College seeks to educate engineers, scientists, and mathematicians well versed in all of these areas and in the humanities and the social sciences so that they may assume leadership in their fields with a clear understanding of the impact of their work on society.

**Accommodations:** HMC is committed to providing an inclusive learning environment and support for all students. Given our current online learning environment, we recognize that the challenges facing students are different and student accommodation needs may change. Students with a disability (including mental health, chronic or temporary medical conditions) who may need some accommodation in order to fully participate in this class are encouraged to contact Educational Accessibility Services at [ability@g.hmc.edu](mailto:ability@g.hmc.edu) to request accommodations. Students from the other Claremont Colleges should contact their home college's disability resources officer.

**Statement on Inclusivity:** In addition to facilitating learning, we work to make our courses inclusive to all students so that everyone feels welcome and supported. I aim to make this class a place where everyone can participate and feel respected, regardless of one’s race, class, or identity. I aim to support LGBTQIA+ students, students with disabilities, and other groups that face marginalization on college campuses and beyond. I truly hope that this class is one where everyone feels welcome and supported.

**Title IX:** For important information from Harvey Mudd College on Title IX, please visit the following website:<https://www.hmc.edu/tix>.

**HMC Honor Code:** All students enrolled in this course are bound by the HMC Honor Code. More information on the HMC Honor Code can be found in the HMC Student Handbook. For those assignments requiring an individual submission, you may discuss such assignments with other students or ask questions of your professor (no other faculty, please), but what you finally submit must be your own solution. Collaboration on assignments is encouraged; however, if you work with, or receive help from, another individual on an assignment, you must provide a short, written acknowledgement that includes the person’s name and the nature of the help.

This document is not meant to be an exhaustive list of every possible Honor Code violation. Infractions not explicitly mentioned here may still violate the Honor Code. We encourage you to check with us if an unusual circumstance arises that you think may violate the Honor Code.

When you find yourself in need of additional help, please talk with your professor. I’m here to help!

**STRUCTURED PRACTICE AND ASSIGNMENTS**

All listed times refer to the Pacific Time Zone.

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| **Assignment** | **Due Dates** | **Description** |
| Preparation and Participation, 32.5% of final grade | Self-assessment at end of each class | I anticipate that you will spend about one to two hours preparing for every class period. This will typically take the form of reading the textbook or literature articles with occasional pre-class videos to watch. Ungraded guided reading questions will be provided for textbook readings. Discussion questions associated with literature articles may be assigned as homework. Your preparation will be evaluated through a self-assessment at the end of each class, which is available on Sakai.  Active participation takes many forms beyond simply attending and speaking in class. Active participation can include asking questions of your professor or classmates in class and/or office hours, participating synchronously on Zoom during scheduled class times, participating asynchronously, engaging with your classmates in breakout rooms by asking or answering questions, listening and taking notes, and writing down questions to ask during office hours. I recognize that studying remotely in distant time zones and the inherent uncertainty of pandemic life may prevent you from attending every Zoom class. Please reach out to me when you have difficulties attending class. You will self-assess your participation at the end of each class using the rubric on Sakai. |
| Homework  32.5% of final grade | Typically Thursdays at class time and/or the day of class literature discussions | There will be periodic homework assignments in this class, which will take the form of problem sets and/or reading questions about a scientific article. Scientific work regularly involves collaboration, and it is fine to work with classmates on homework. Neatly list the names of your collaborators on your homework and see the Honor Code section of this document to learn more about collaborating. When homework involves plotting data and making graphs, each student must plot their own data individually as the ability to plot data is an important skill. Sharing copies of a graph with classmates is a violation of the Honor Code. **Your lowest homework score will be dropped**. |
| Student choice project, 35% of final grade | See handout with details | Each of you in this class brings a wonderfully wide range of interests and experience. In order to let you see how your interests intersect with bioinorganic chemistry, you will complete a student choice project. See project handout for details. |