426 Chem. 3 (2+1)
Bio – inorganic Chemistry

Catalogue Description:

1. *The alkali metals and alkaline earth cations in biosystems.*
2. *Non-redox metalloenzymes.*
3. *Oxygen carriers and oxygen transport proteins, electron transfer and*
4. *photosynthesis.*
5. *Heam proteins and copper proteins in redox reactions, vitamin B12.*
6. *Nitrogen fixation and iron-molybdenum-sulphur proteins.*
7. *Metal ion transport and storage.*
8. *Metals and non-metals in biology and medicine*
9. *Physical measurements.*

Aims and Objectives:

Bioinorganic Chemistry links inorganic chemistry to biochemistry, describing the relationship between these two disciplines. It discusses the structure and function of inorganic elements, ions, coordination compounds and mineralization in living systems, including the use of inorganics in medicinal fields of therapy and diagnosis. The role of inorganic reactions in the living systems is of extreme importance. Hence, a thorough understanding of the science behind these reactions is essential.

This course was designed to offer students an overview of bio-inorganic chemistry through selected topics, in a fashion that is concise and related –in most- to human biology. It aims at enabling the student to apply the core inorganic concepts gained through previous courses to understand how inorganic species control biological reactions.

Course Outcomes

At the end of this course students would be able to:

- Demonstrate proficiency in the basic principles of in the field of bio-inorganic chemistry.
- Identify the appropriate analytical techniques that are useful in characterizing transition-metal complexes in biological molecules.
- Describe the different processes involved in the transport and storage of metal ions.
- Describe the role of the most common metal ions and metal centers that are involved in electron-transfer reactions in biological systems.
- Understand how oxygen is transported through the human body and identify related metal centers.
- Account for calcium biominerals in humans.
- List and concisely describe some of the medical applications of metal ions.

Topics

Part I: Overview

- Introduction
- The inorganic composition of cells
- Terminology
- The biological functions of elements
- Analytical techniques

Part II: Transport and storage of metal ions

- Sodium and potassium transport
- Iron storage and transport
- Hemoglobin and myoglobin

Part III: Electron transfer reactions

- Biological redox processes
- Mitochondrial e-transfer chain
- NAD^+/NADH couple

Part IV: Biominerals

- Biomineralization
- Ca compounds in biological systems

Part V: Applications in Medicine

- Diagnosis
- Treatment

Class organization

In-class: Power Point presentations will be used as the major visual aid in the class. Learning of this subject requires reading and understanding of the course materials provided and suggested references.

Off-class: Students are expected to lead independent learning through different assignments. **I**ndividual consultations are offered during office hours or by an appointment (via e-mail).

Evaluation

- Midterm and final exam questions will be a mixture of multiple choice and essay-type questions (Parts I – IV).
- Short assignments[1] on parts I-IV.
- A report assignment should be prepared independently by the student on selected topics ([2]Part V).

[1]To be prepared according to certain criteria and published at LMS.

[2] Each student is expected to suggest a topic that falls within part V, then prepare a report according to a given template published at LMS.

Grading

Activity	Marks
Midterm exams.	40
Assignments	20
Final exam	40
Total	100

Course Calendar

Activity	Week	Date
Mid 1	7	23/1/1438
Mid 2	11	28/2/1438
Assignments	Continuous	To be scheduled
Final Examination	As per timetable	

Reading list

1. C. Housecroft and A. Sharpe, *Inorganic Chemistry*, Pearson, 2nd edition (e-book in library, 4th edition in market).
2. P. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong and M. Hagerman, *Shriver & Atkin's Inorganic Chemistry*, Oxford Univ. Press, 5th Edition.