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| **logo University of Management & Technology**  School of Science  Department of Chemistry | | | | |
| CH-654 (BIOINORGANIC CHEMISTRY) | | | | |
| **Lecture Schedule** | **Sec A** | **Semester** | | Fall 2022 |
| **Pre-requisite** | Nil | **Credit Hours** | | 3 |
| **Instructor** | Dr. Abdul Rauf | **Contact** | | [abdulrauf@umt.edu.pk](mailto:abdulrauf@umt.edu.pk) |
| **Office** | 3S-32 Hall | **Office Hours** | | See office window |
| **Course Description** | The more advanced chemical and biochemical aspects and methods are all developed during the course. The course will provide students with a general overview of the many very fundamental tasks performed by inorganic elements in living organisms as well as the related methods and theories with particular emphasis on enzymatic conversions and electron transfer. This goes along with the elucidation of model systems and technical applications of both, concepts learned from nature as well as biological systems. | | | |
| **Expected Outcomes** | The course “Bioinorganic Chemistry” provides students with a detailed knowledge of fundamental aspects of the subject, while it focuses on current topics, e.g. metallo-enzymes in metabolism and synthesis, technical applications of hydro-genases or metal containing pharmaceuticals. Students who complete the course are expected to understand the concepts of coordination chemistry in biological environments, and to utilize this knowledge to analyze the influence of such an environment on the reactivity of a metal centre. This expertise should serve as a tool for development of e.g. metallo-enzyme applications, material synthesis and pharmaceutical development. The course is designed for MS and PhD students in chemistry and biotechnology. | | | |
| **Textbook**  **&**  **Reference Book (Text)** | * Biological Inorganic Chemistry – Structure & Reactivity, Ivano Bertini, Harry B. Gray, Edward I. Stiefel, Joan Selverstone, 2007. * Bioinorganic Chemistry, University Science Books, Bertini, 1994. Available at Sciences Library Permanent Reserve. * The Biological Chemistry of the Elements: The Inorganic Chemistry of Life. J. J. R. Fausto da Silva and R. J. P. Williams. Oxford University Press, Oxford, United Kingdom. 2001 * Bioinorganic Chemistry, A Short Course, R. M. Roat-Malone, Wiley-Interscience, 2007. * Bio-inorganic chemistry. Hay, Robert Walker. Chichester: Ellis Horwood, 1984. * Physical Methods in Bioinorganic Chemistry. L. Que, University Science Books, Sausalito, California, 2000. | | | |
| **Grading Policy** | Quizzes 20%  Assignments 5%  Presentation + Case study 5+5 %  Midterm Exam 25%  Final Exam: 40% | | All quizzes will be announced well before time.  No make-ups will be offered for missed quizzes. | |

**CH-654 (BIOINORGANIC CHEMISTRY)**

**Lecture plan (Fall 2020)**

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| **Week &**  **Lectures** | **TOPICS** | **CH** |
| 1 | Introduction: What Bioinorganic Chemistry? General terms, how and why does nature select inorganic elements? Inorganic Elements and evolution | I, II |
| 2 | Basic biological Coordination Chemistry. Kinetic and spectroscopic characteristics of bioinorganic systems. | III, IV |
| 3 | Stroll through the periodic system. Systematic overview over tasks and examples of inorganic elements in biology | III, IV |
| 4 | Ion transport: membranes, Energy, Channels, Pumps | V |
| 5 | Biomineralization: the hard part of bioinorganic chemistry | VI |
| 6 | Nanoparticles, Inorganic structural elements in proteins, RNA & DNA, Lewis acid catalysis | XIV, IX |
| 7 | Bioinorganic coordination chemistry II – transition metals | X |
| 8 | Electron transport in biology – iron sulfur clusters, enzymes for respiration, photosynthesis and related pathways | X |
| 9 | **MID TERM EXAM** |  |
| 10 | Oxygen transport – metal-oxygen coordination in proteins | XI |
| 11 | Oxygen activation, processing by cytochromes | XI |
| 12 | Small molecule activation and conversion by metalloenzymes– photosynthetic water splitting | X , XI |
| 13 | Radicals and Bio-organometallic Chemistry – from RNA to DNA and from Vitamin B12 to methanogens and methanotrophs. | XIII |
| 14 | Biological conversion and formation of hydrogen and nitrogen– hydrogenases and nitrogenases | XII |
| 15 | Metal pharmacology: uptake storage toxicity | VIII |
| 16 | Metals in medicine: | VII |
| 17 | anticancer agents, diabetes, arthritis, radionuclides and related applications. | VII |
| 18 | Final Exam |  |

**NOTE:**   
This syllabus is tentative and subject to change at the instructor’s discretion.