UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

METAL PROTEIN CHEMISTRY

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	CHIM/03 (GENERAL AND INORGANIC CHEMISTRY)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	ADVANCED BIOTECHNOLOGY
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	1st semester (01/10/2021 - 14/01/2022)
ECTS	6
Lesson hours	48 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	NICOLIS STEFANIA (titolare) - 3 ECTS DELL'ACQUA SIMONE - 3 ECTS
Prerequisites	Knowledge of chemistry provided in the courses of General and Inorganic Chemistry and Organic Chemistry of the bachelor degree in Biotechnology.
Learning outcomes	Module 1: The module aims to describe the structural basis for understanding the mechanisms of action of proteins and enzymes containing metal centers as heme iron, non-heme iron, copper, zinc and calcium, as well as the factors that determine the specific use of the metals. Module 2 aims at describing advanced aspects of metalloproteins and metalloenzymes mechanisms of action. The enzymatic mechanism will be described including a detailed description of how the catalytic center evolves towards active intermediates of the catalytic process.

Course contents	Module 1 - The main topics covered in the module are as follows: introduction to bioinorganic chemistry, mechanisms of metal transporter, essential metals, structure and function of proteins, metal complexes with amino acids, peptides, and proteins, metal catalysis, processes of insertion of metal cofactors into proteins, biochemistry of alkali and alkaline earthy metals, calcium-proteins; properties and reactivity of oxygen, metal-dioxygen complexes (iron-porphyrins, copper, cobalt). Module 2 - The course will describe the chemical and biological properties of proteins and enzymes containing heme, non-heme iron, copper and zinc cofactors. The main focus will be the description of the following biological processes and reactions: oxygen transport (hemoglobin/myoglobin, hemocyanin), cellular respiration (cytochrome c oxidase), hydrolysis reactions (hydrolases containing zinc) and more generally biological oxidations (peroxidases, cytochrome P450 , tyrosinase, etc.).
Teaching methods	Interactive lectures carried out by projection of slides and handouts provided to students as teaching material and in-depth analysis on the blackboard. Additional lessons on coordination chemistry and molecular orbitals are provided for students of the Master's Degree in Advanced Biotechnology who have not attended the Bioinorganic Chemistry course in the bachelor degree. The course does not include practical exercises.
Reccomended or required readings	=
Assessment methods	There will be a single oral examination relating to the two modules of the course. In particular, as regards Module 1, one or two questions (numerical data or specific chemical reactions used only as examples in the handouts are not required) relating to the topics covered in class; as regards Module 2, the student will have to describe in detail a metalloprotein (chosen by the teacher) for each of the four classes (heme iron, non-heme iron, copper, zinc), paying particular attention to the coordination of the metal site and, in the case of enzymes, to the catalyzed reaction and to the catalytic cycle.
Further information	There will be a single oral examination relating to the two modules of the course. In particular, as regards Module 1, one or two questions (numerical data or specific chemical reactions used only as examples in the handouts are not required) relating to the topics covered in class; as regards Module 2, the student will have to describe in detail a metalloprotein (chosen by the teacher) for each of the four classes (heme iron, non-heme iron, copper, zinc), paying particular attention to the coordination of the metal site and, in the case of enzymes, to the catalyzed reaction and to the catalytic cycle.
Sustainable development goals - Agenda 2030	7 9 12 15 The goals