

Module Details	
Module Title	Bio-organic and Bio-inorganic Chemistry
Module Code	CFS6014-B
Academic Year	2022/3
Credits	20
School	School of Chemistry and Biosciences
FHEQ Level	FHEQ Level 6

Contact Hours	
Type	Hours
Interactive Learning Objects	18
Lectures	14
Practical Classes or Workshops	12
Tutorials	4
Directed Study	158

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 1

Module Aims
This module will draw together organic chemistry, inorganic chemistry and biology at an advanced level with application to case studies. An advanced introduction to biomolecules will be followed by topics that investigate biological processes, with a focus on those that involve metal ions, and how synthetic molecules can interact with biomolecules as potential therapeutic agents. The properties of metals used in the synthesis of bioinorganic drugs, imaging and diagnostic agents will be covered and students will examine the chemistry that governs the use of metal ions in biological systems to develop an understanding of the underlying principles that explain the role of metal ions in bioinorganic systems.

Outline Syllabus

Biomolecule Structure and Function: Four major classes of biomolecules (carbohydrates, nucleic acids, proteins and lipids) and monomer constituents; biomolecular interactions; protein folding and misfolding; nucleic acid structures; carbohydrate stereochemistry and reactivity.

Genetic Flow of Information: DNA replication; protein biosynthesis (translation and transcription) and nuclear enzymes.

Molecular recognition and interactions: interactions between biomolecules; kinetics and thermodynamics of binding; allostery; receptor agonists and antagonists; drug interactions.

Membranes and Ion Transport: Lipid chemistry; structure and composition of cell membranes; mechanisms of ion transport.

Enzymes: enzymes and coenzymes in biosynthetic processes; classification of enzymes; enzyme kinetics (Michaelis-Menten and non Michaelis-Menten behaviour); enzyme inhibition; metalloproteins and metals (Fe, Co, Ni, Cu, Zn) as cofactors in proteins; transition state analogue inhibitors.

Biochemistry of Transition Metals and Homeostasis: Importance of balanced distribution of elements; essential elements; regulation of metal ion concentration (metalloregulation); role of (transition) metals in biology.

Medicinal Bioinorganic Chemistry: anti-cancer metal-based drugs; chelation therapy; anti-inflammatory metal-based drugs; vaccines and adjuvants; **Metals and Metalloids in Diagnostic Imaging:** Introduction to fluorescence and luminescence; MRI and contrast agents; introduction to radionuclides; metal-based radiopharmaceuticals for PET and SPECT; MRI and contrast agents.

Learning Outcomes	
Outcome Number	Description
01	Discuss and detail the structure and function of the four classes of biological molecules, including the assembly of supramacromolecular structures from constituent monomers and subunits
02	Discuss and describe how nucleic acids enable the storage, replication and expression of genetic information.
03	Explain and critically discuss specific modes of binding and the molecular recognition by biomolecules of substrates, ligands and therapeutics.
04	Demonstrate breadth, depth of awareness and understanding of the chemistry and biochemistry of metals and how this can be applied in development of bioinorganic therapeutics.
05	Explain the role of enzymes and key aspects of enzymology, analyse kinetic data and devise arguments based on physicochemical effects and mechanisms.
06	Explain and critically discuss the importance of metal ions in biological processes, including transport mechanisms, homeostasis and metalloregulation, and the health consequences of dysregulation.
07	Demonstrate breadth, depth of awareness and understanding of the chemistry of metals that underlay their use in medical imaging and as diagnostic agents.
08	Illustrate the reaction schemes for the synthesis of subject-specific compounds and identify their structures and properties.
09	Demonstrate breadth and depth of understanding on a selected topic in bioorganic and bioinorganic chemistry and communicate findings in writing, observing appropriate professional conventions in chemistry.
10	Critically evaluate and select data and literature sources based on accuracy and relevance to a selected topic in bioorganic and bioinorganic chemistry.

Learning, Teaching and Assessment Strategy
The module uses a blended approach to support learning and achievement. Students will engage with a series of weekly online learning packages. These will include short videos that address key concepts, a set of structured activities (reading, online discussions etc.) that 'scaffold' the learning, and a range of formative tasks that generate feedback on progress. Online workshops will facilitate topic-based investigations done in small student groups. Online tutorials will also be used to support learning and monitor progress as students move through the curriculum. Assessment 1: Mini-review article. LOs 1-10. Assessment 2: Summative examination. LOs 1-8.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Coursework - Written	Mini-review Article (1500 words)	30%
Summative	Examination - Closed Book	Summative Assessment: Closed Book (2 Hrs)	70%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

© University of Bradford 2022

<https://bradford.ac.uk>