

Module Details	
Module Title	Bio-organic and Bio-inorganic Chemistry
Module Code	CFS6014-B
Academic Year	2024/5
Credits	20
School	School of Chemistry and Biosciences
FHEQ Level	FHEQ Level 6

Contact Hours	
Type	Hours
Directed Study	154
Interactive Learning Objects	18
Lectures	14
Practical Classes or Workshops	8
Tutorials	6

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

Module Aims
<p>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 interlaced with disease-related and drug development case studies, with a focus on those that involve metal ions. This material will cover how synthetic molecules 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.</p>

## Outline Syllabus

**Biomolecule Structure and Function:** Biological macromolecule structures and stability, including different types of proteins (e.g. membrane and globular, metalloprotein); protein folding; nucleic acid structures and DNA replication, translation and transcription; carbohydrate stereochemistry and reactivity.

**Molecular recognition and interactions:** interactions between biomolecules; kinetics and thermodynamics of binding; allostery; drug interactions.

**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 Metals:** essential elements; homeostasis; regulation of metal ion concentration (metalloregulation) and ion transport mechanisms; role of (transition) metals in biology with a comparison of main group and transition metal functions.

**Medicinal Bioinorganic Chemistry:** metal-based drugs; modes of action; chelation therapy.

**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.

## Learning Outcomes

Outcome Number	Description
01	Discuss and detail the structure, stability, and function of biological macromolecules, and key non-covalent interactions.
02	Explain and critically discuss specific modes of binding, mechanisms of action, and molecular recognition by biomolecules of substrates, ligands, and therapeutics.
03	Explain the role of enzymes and key aspects of enzymology, analyse kinetic data and devise arguments based on physicochemical effects and mechanisms.
04	Demonstrate breadth, depth of awareness, and understanding of the chemistry and biochemistry of metals and their use in bioinorganic therapeutics.
05	Explain and critically discuss the importance of metal ions in biological processes, including transport mechanisms, homeostasis and metalloregulation, and the health consequences of dysregulation.
06	Explain and assess synthetic strategies used in the development of bioorganic and bioinorganic therapeutics.
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	Describe underlying scientific principles involved in medical diagnostics and imaging using metal complexes.
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. Lectures will expand on fundamentals covered in the online learning packages. Workshops will facilitate topic-based investigations and coursework development. Tutorials will support learning and monitor progress as students move through the curriculum.

Assessment 1: Written coursework on a selected topic. LOs 9 and 10.

Assessment 2: Summative examination. LOs 1-8.

## Mode of Assessment

Type	Method	Description	Weighting
Summative	Coursework - Written	Coursework 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.*