

Module Details	
Module Title:	Bio-organic and Bio-inorganic Chemistry
Module Code:	CFS6014-B
Academic Year:	2019-20
Credit Rating:	20
School:	School of Chemistry and Biosciences
Subject Area:	Chemistry
FHEQ Level:	FHEQ Level 6
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	Hours
Lectures	26
Tutorials	18
Directed Study	156

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 1 (Sep - Jan)

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 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.</p>

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

1	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
2	Discuss and describe how nucleic acids enable the storage, replication and expression of genetic information.
3	Explain and critically discuss specific modes of binding and the molecular recognition by biomolecules of substrates, ligands and therapeutics.
4	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.
5	Explain the role of enzymes and key aspects of enzymology, analyse kinetic data and devise arguments based on physicochemical effects and mechanisms.
6	Explain and critically discuss the importance of metal ions in biological processes, including transport mechanisms, homeostasis and metalloreulation, and the health consequences of dysregulation.
7	Demonstrate breadth, depth of awareness and understanding of the chemistry of metals that underlay their use in medical imaging and as diagnostic agents.
8	Illustrate the reaction schemes for the synthesis of subject-specific compounds and

	identify their structures and properties.
9	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

Lectures will deliver core content and provide you with the opportunity to enhance your knowledge and understanding of inorganic and organic chemistry within a biological context. Lectures will be complemented by workshops, group discussions and tutorials to allow you to apply this learning to specific topic areas and problems. Students will research the literature and critically analyse material on a provided study topic as a group and develop their written communication skills further through preparation of an individual mini-review in the style of a communication article. The VLE will be used to provide access to online resources, lecture notes and external links to websites of interest. Directed study will provide them with the opportunity to undertake guided reading and develop in-depth understanding of the subject material.

Assessment 1: Mini-review article. LOs – 1-10.

Assessment 2: Summative examination. LOs 1-8.

### Mode of Assessment

Type	Method	Description	Length	Weighting
Summative	Examination - closed book	Summative Assessment: Closed Book	2 hours	70%
Summative	Coursework	Mini-review article (1500 words)	0-1500 words	30%

### 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.*