CH278-15 Macromolecules

24/25

Department
Chemistry
Level
Undergraduate Level 2
Module leader
Remzi Becer
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Macromolecules are central to life. Nature has created natural macromolecules such as cellulose to enable trees and plants to form and DNA and RNA for the evolution and coding of life. Scientists have developed synthetic macromolecules to be used in wide range of materials owing to the physical properties of macromolecules. This module will cover the synthetic concepts and structures of both synthetic and natural polymers as well as discussing their use in our daily lives.

Module web page

Module aims

1. To introduce the methods for organic synthesis of macromolecules (polymers)
2. To introduce the relationships between chemical structure, stereochemistry and physical properties.
3. To describe the physical and analytical methods that enable us to understand these relationships in synthetic polymers.
4. To introduce the building blocks of natural polymers: nucleosides, amino acids, peptides, and carbohydrates.
5. To build an understanding of how the macromoelcules made from these building blocks (RNA, DNA, proteins and polysaccharides) are biosynthesized and the information encoded

within them is transferred in living and cell-free systems.
6. To demonstrate an understanding of the current scientific and business landscape related to the application of synthetic and natural macromolecules.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

The topics that will be covered in this module are; radical polymerisation, ionic polymerisation and ring opening polymerisation, coordination polymerization, polyolefins and ring-opening metathesis polymerization (ROMP), Ziegler-Natta catalysis, stereochemistry, step growth polymerisation, Polymer physics: chemical structures translated into material properties.
Nucleic acids, DNA, RNA and the ‘Central Dogma’ of informational transmission, amino acids, peptides and proteins. Six-membered rings and fundamentals of sugar chemistry, carbohydrates, combination of synthetic and natural macromolecules.

Learning outcomes

By the end of the module, students should be able to:

- Have an appreciation for the concept that macromolecules (synthetic or biological) can be assembled into larger (macromolecular) structures from simple monomeric units using (bio)synthetic methods.
- Be able to demonstrate a conceptual understanding of, and be familiar with, the fundamental principles and approaches to synthesise macromolecules and related characterisation methods.
- Understand the structure, properties and reactivities of biological macromolecules, including: DNA/RNA, peptides/proteins and sugars/carbohydrates.
- Understand the way natural macromolecules are described in biological databases and the fundamentals of how to search within these databases. o Be able to identify appropriate methods for the analysis of biological and synthetic macromolecules.
- Create a business plan for a selected topic related to macromolecules and design a presentation to communicate this to an audience of scientifically literate peers.

Indicative reading list

- Introduction to polymers (Young and Lovell), Polymer Chemistry (Hiemenz and Lodge).
- Principles of Polymerisation (Odian), Wiley, Hoboken N.J., 4th edn, 2004. https://pugwash.lib.warwick.ac.uk/record=b2568724
- Organic Chemistry Clayden, Greaves, Wothers 2/e https://bibliu.com/app/#/view/books/9780192518545/epub/OEBPS/Chapter-42.html#page_1136
- Molecular Biology of the Cell B Alberts et al. available free on NCBI website https://www.ncbi.nlm.nih.gov/books/NBK26887/
- Biochemistry, Berg, Tymoczo, Stryer, Gatto 8/e https://go.exlibris.link/1tc23GTy

Research element

Students will be working in teams of 6 to research a topic to prepare a business case related to macromolecules.

Interdisciplinary

The topic of macromolecules requires interdisciplinary thinking as it connects chemistry to physics and biology.

Subject specific skills

Students will be learning industrially applied synthetic methods for the preparation of macromolecules. They will also develop a good understanding on the chemical structure-physical property relationships. The chemical industry on production of plastics as well as biomedical materials have been expanding enormously owing to the unique material properties of synthetic materials that creates a business and employment opportunities for students.

Transferable skills

Communication,
Critical thinking
Information literacy
Professionalism
Teamwork.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	2 sessions of 1 hour (1%)
Practical classes	4 sessions of 1 hour (3%)
Private study	84 hours (56%)
Assessment	30 hours (20%)
Total	150 hours

Private study description

N/A

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time	Eligible for self-certification
Business Plan	20%	30 hours	No
Each team will produce a business plan which they will then present in a 10 minute pitch to their peers.			
Examination	80%		No

- Answerbook Green (8 page)
- Students may use a calculator
- Graph paper
- Periodic Tables

Assessment group R

	Weighting	Study time	Eligible for self-certification
Examination	100%		No

- Answerbook Green (8 page)
- Students may use a calculator
- Graph paper
- Periodic Tables
- Thermodynamic and Transport Properties of Fluids (ES4D90)

Feedback on assessment

Feedback on assessed work provided via Moodle. Cohort level examination feedback will be provided after the June examination period.

Past exam papers for CH278

Availability

Courses

This module is Core for:

- UCHA-4 Undergraduate Chemistry (with Intercalated Year) Variants
  - Year 2 of F101 Chemistry (with Intercalated Year)
  - Year 2 of F122 Chemistry with Medicinal Chemistry (with Intercalated Year)
- UCHA-3 Undergraduate Chemistry 3 Year Variants
  - Year 2 of F100 Chemistry
  - Year 2 of F121 Chemistry with Medicinal Chemistry
- UCHA-F110 Undergraduate Master of Chemistry (with Industrial Placement)
  - Year 2 of F100 Chemistry
  - Year 2 of F110 MChem Chemistry (with Industrial Placement)
  - Year 2 of F112 MChem Chemistry with Medicinal Chemistry with Industrial Placement
- Year 2 of UCHA-F107 Undergraduate Master of Chemistry (with Intercalated Year)
- UCHA-F109 Undergraduate Master of Chemistry (with International Placement)
  - Year 2 of F109 MChem Chemistry (with International Placement)
  - Year 2 of F111 MChem Chemistry with Medicinal Chemistry (with International Placement)
- UCHA-4M Undergraduate Master of Chemistry Variants
  - Year 2 of F100 Chemistry
  - Year 2 of F105 Chemistry
  - Year 2 of F110 MChem Chemistry (with Industrial Placement)
  - Year 2 of F109 MChem Chemistry (with International Placement)
  - Year 2 of F125 MChem Chemistry with Medicinal Chemistry
- Year 2 of UCHA-F127 Undergraduate Master of Chemistry with Medicinal Chemistry(with Intercalated Year)