

# CH167-15 Carbon and the Chemistry of Life

**23/24**

**Department**

Chemistry

**Level**

Undergraduate Level 1

**Module leader**

Mark Greenhalgh

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

100% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

A module focused on the fundamentals of the chemistry of carbon and how it applies to chemical biology as part of the chemistry of life.

[Module web page](#)

### Module aims

To build on the fundamental knowledge acquired from the Term 1 modules to apply concepts to basic organic and biological chemistry.

The module builds on the fundamental knowledge acquired from the previous chemistry modules, specifically in terms of chemical bonding, structure, reactivity, mechanism and the names of simple functional groups. New concepts within the module apply an understanding of organic chemistry to the synthesis and chemistry of a variety of functional groups, how this can be monitored by key analytical techniques and how this applies in a biological context as part of the chemistry of life.

The content of this module will be assumed in ALL subsequent Chemistry modules. It provides all entering first year students with a common foundational knowledge of organic chemistry. This will

be achieved by a range of teaching methods, primarily lectures and tutorials, but also student-centred learning, including directed reading, in-class problems and workshops as well as set exercises. The majority of the module content is drawn from components of A-level syllabuses. As such, most students will already be familiar with some aspects of the module syllabus, but the pattern of familiarity will be heterogeneous across the class. The primary aim of this and the other Year 1 chemistry modules is to equip all students with the necessary fundamental knowledge and skills to succeed in their chemistry degree at Warwick.

## 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.

### Topic A: Analytical chemistry for synthesis

- Focussing less on the underlying principles behind spectroscopic methods, but more on how key analytical methods for this module (IR, mass spec, 1D NMR, polarimetry, etc.) can be used to determine the outcomes of reactions.

### Topic B: The fundamentals of chemical biology and the chemistry of life

- To include amino acids, lipids, carbohydrates, but not DNA/RNA or central dogma aspects.

### Topic C: Conformation and configuration

- Building on the fundamentals covered in the first Term module to discuss:
  - Bond rotation
  - Cations and anions
  - Hyperconjugation and conjugation
  - Stereochemistry (chirality, CIP rules, relative/absolute, achiral diastereoisomers, polarimetry)
  - Biological examples to illustrate and practice

### Topic D: Substitution and elimination reactions

- Building on the fundamentals covered in the first Term module to discuss:
  - Electrophiles and nucleophiles
  - pKa
  - Biological examples to illustrate
  - Substitution reactions
  - Elimination reactions

### Topic E: Carbonyl chemistry

- The chemistry of aldehyde/ketone derivatives
- The chemistry of carboxylic acid derivatives
- Keto-enol tautomerisation
- The chemistry of enols and enolates
- Biological examples to highlight the concepts- amide bonds and enzyme catalysis, lipids and fatty acids

## Topic F: The chemistry of carbon-carbon $\pi$ -bonds

- Electrophilic addition to alkenes and alkynes
- Limited to electrophilic addition, saving nucleophilic for Y2
- Building on the fundamentals of aromaticity discussed in Module 1
- Electrophilic aromatic substitution
- Limited to mono/di-substitution and directing effects. Leaving competitive/cooperative directing effects and nucleophilic aromatic substitution for Y2.

### Learning outcomes

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

- Be able to demonstrate an understanding and awareness of different reactions in organic chemistry and why & how they take place.
- Be able to demonstrate an understanding of the structure, shape, properties and reactivity of organic molecules including their acidity, mechanisms and reactions.
- Have a basic understanding of mechanisms and their stereochemical consequences of nucleophilic substitution, elimination, electrophilic additions/substitutions, oxidations and reductions.
- Have a basic understanding of mechanisms of carbonyl and enolate chemistry.
- Be able to use their knowledge of general mechanisms and reactivity to postulate mechanisms of organic reactions using curly arrows.
- Be able to use their knowledge to be able to design short syntheses of organic molecules.
- Understand the links between the structure, reactivity, synthesis and physical properties of biological molecules (lipids, amino acids, and carbohydrates) to the fundamental organic chemistry concepts in the module.
- Be able to appraise the outcome of a reaction based on spectroscopic analysis (focussing on IR, 1D NMR, mass spec and polarimetry).

### Indicative reading list

Essential Text (required):

- Clayden, Greeves, Warren and Wothers, Organic Chemistry, Oxford, second edition 2012
- Advised texts (recommended but not required):
- Mechanism in Organic Chemistry, 6th Edition, Peter Sykes, Pearson Prentice Hall
  - Introduction to Stereochemistry, RSC Chemistry Student Guides, Clark, Kitson, Mistry, Taylor, Taylor, Akamune, Lloyd

### Interdisciplinary

Spans the boundary between chemistry and biochemistry

### Subject specific skills

Problem-solving

## Transferable skills

Problem-solving, use of technology and software, teamwork

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## Study

### Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	3 sessions of 1 hour (2%)
Work-based learning	3 sessions of 1 hour (2%)
Other activity	5 hours (3%)
Private study	109 hours (73%)
Total	150 hours

### Private study description

N/A

### Other activity description

1 hr non assessed class test, 4 hrs revision sessions

## Costs

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

### Assessment group B

	Weighting	Study time
Written exam	100%	

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

## Feedback on assessment

Cohort level examination feedback provided via Moodle following the Exam Board.

[Past exam papers for CH167](#)

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## Availability

### Courses

This module is Core for:

- UCHA-4 Undergraduate Chemistry (with Intercalated Year) Variants
  - Year 1 of F101 Chemistry (with Intercalated Year)
  - Year 1 of F122 Chemistry with Medicinal Chemistry (with Intercalated Year)
- UCHA-3 Undergraduate Chemistry 3 Year Variants
  - Year 1 of F100 Chemistry
  - Year 1 of F100 Chemistry
  - Year 1 of F121 Chemistry with Medicinal Chemistry
- UCHA-F110 Undergraduate Master of Chemistry (with Industrial Placement)
  - Year 1 of F100 Chemistry
  - Year 1 of F110 MChem Chemistry (with Industrial Placement)
  - Year 1 of F112 MChem Chemistry with Medicinal Chemistry with Industrial Placement
- Year 1 of UCHA-F107 Undergraduate Master of Chemistry (with Intercalated Year)
- UCHA-F109 Undergraduate Master of Chemistry (with International Placement)
  - Year 1 of F109 MChem Chemistry (with International Placement)
  - Year 1 of F111 MChem Chemistry with Medicinal Chemistry (with International Placement)
- UCHA-4M Undergraduate Master of Chemistry Variants
  - Year 1 of F100 Chemistry
  - Year 1 of F105 Chemistry
  - Year 1 of F110 MChem Chemistry (with Industrial Placement)
  - Year 1 of F109 MChem Chemistry (with International Placement)
  - Year 1 of F125 MChem Chemistry with Medicinal Chemistry
- Year 1 of UCHA-F127 Undergraduate Master of Chemistry with Medicinal Chemistry (with Intercalated Year)