CBMS303

Organic and Biological Chemistry A

S2 Day 2015

Dept of Chemistry & Biomolecular Sciences

Contents

General Information

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Credit points
3

Prerequisites
CBMS204 and (3cp from CBMS200-CBMS203 or CBMS205-CBMS234)

Corequisites

Co-badged status
CBMS803

Unit description
Biological systems carry out a huge range of complex organic reactions to achieve growth, to reproduce and to compete. This unit, together with CBMS304, examines advanced topics in organic chemistry, relevant to biology and biological systems. This unit has an underlying theme of the structure and reactivity of proteins and peptides but looks at these from the fundamental principles of organic chemistry. Specific topics include: carboxylic acids and amines; amino acids, peptides and proteins; polar rearrangements; and spectroscopic identification of organic compounds. These topics build upon the foundation of CBMS204, using the same text book supplemented by notes given out in lectures and inexpensive Oxford Chemistry Primers on specialised topics. This unit requires good skills in organic chemistry; a background in other aspects of chemistry and/or biochemistry will be advantageous. The laboratory sessions are aimed at developing skills in organic chemistry, using reactions studied in lectures and in the spectroscopic identification of organic molecules.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature

Have a chemical understanding of carbocation/carbanion stability and reactivity

Predict the products of rearrangement reactions given the starting material and reagent(s)

Deduce a mechanism for a rearrangement reaction given the starting material and product(s)

Have an understanding of the factors affecting reactivity of organic chemicals

Outline some syntheses of alpha amino acids

Plan a synthesis of a peptide, requiring protecting and activating groups either in solution or in solid phase synthesis

Deduce the structure of an unknown peptide given results from chemical and enzymic hydrolysis

Interpret and predict the mechanism of polar rearrangements

Plan and carry out a synthesis using a polar rearrangement using a literature method

Plan and carry out a synthesis or a dipeptide

Write a report in a scientific format

Assessment Tasks

Name	Weighting	Due
Practical Reports	25%	1 week after the lab
Workshop performance	15%	TBA
Mid-semster Examination	10%	TBA
Final Examination	50%	TBA

Practical Reports

Due: **1 week after the lab**
Weighting: **25%**

The reports will essentially follow the style of CBMS204 (you submitted five of these, so you should know exactly what is expected of you), unless you are instructed otherwise.

The report will include the pre-work (all safety hazard assessment documents, flow charts, mechansims and answers to any questions that may have been asked) that MUST be completed BEFORE the laboratory session), a write up of the work that was done, calculations of yields, a discussion of the experimental results (including relevant spectra), a comparison with any literature related to the work (with complete referencing of that literature), and answering any questions associated with the post-work.

On successful completion you will be able to:

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products of rearrangement reactions given the starting material and reagent(s)
- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
- Have an understanding of the factors affecting reactivity of organic chemicals
- Outline some syntheses of alpha amino acids
- Plan a synthesis of a peptide, requiring protecting and activating groups either in solution or in solid phase synthesis
- Deduce the structure of an unknown peptide given results from chemical and enzymic hydrolysis
- Interpret and predict the mechanism of polar rearrangements

- Plan and carry out a synthesis using a polar rearrangement using a literature method
- Plan and carry out a synthesis or a dipeptide
- Write a report in a scientific format

Workshop performance

Due: **TBA**
Weighting: **15%**

You will be graded on your level of preparedness and participation. These are problem solving sessions and exam style questions will be completed.

On successful completion you will be able to:

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products of rearrangement reactions given the starting material and reagent(s)
- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
- Have an understanding of the factors affecting reactivity of organic chemicals
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- Plan a synthesis of a peptide, requiring protecting and activating groups either in solution or in solid phase synthesis
- Deduce the structure of an unknown peptide given results from chemical and enzymic hydrolysis
- Interpret and predict the mechanism of polar rearrangements
- Plan and carry out a synthesis using a polar rearrangement using a literature method
- Plan and carry out a synthesis or a dipeptide

Mid-semster Examination

Due: **TBA**
Weighting: **10%**

An examination on the first 6 weeks of course material

On successful completion you will be able to:

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity

- Predict the products of rearrangement reactions given the starting material and reagent(s)
- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
- Have an understanding of the factors affecting reactivity of organic chemicals
- Outline some syntheses of alpha amino acids
- Plan a synthesis of a peptide, requiring protecting and activating groups either in solution or in solid phase synthesis
- Deduce the structure of an unknown peptide given results from chemical and enzymic hydrolysis
- Interpret and predict the mechanism of polar rearrangements
- Plan and carry out a synthesis using a polar rearrangement using a literature method
- Plan and carry out a synthesis or a dipeptide

Final Examination

Due: **TBA**
Weighting: **50%**

Final exam, in the format of previous examinations for this unit

On successful completion you will be able to:

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products of rearrangement reactions given the starting material and reagent(s)
- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
- Have an understanding of the factors affecting reactivity of organic chemicals
- Outline some syntheses of alpha amino acids
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- Interpret and predict the mechanism of polar rearrangements
- Plan and carry out a synthesis using a polar rearrangement using a literature method
- Plan and carry out a synthesis or a dipeptide

Delivery and Resources

Office Hours

There are no formal office hours for this unit. The teaching staff are happy to receive students outside of the formal lecture and practical times but please be aware that we are not always to be found in our offices. It is generally wise to organise an appointment in advance, generally via email (using your university email address).

Required and Recommended texts and/or materials

“Organic Chemistry”, 8th Edition (2008) by John McMurry; Brooks/Cole (this is the same book as for CBMS204).

“Polar Rearrangements”, (1992) by Laurence M. Harwood; Oxford Chemistry Primer QD281.R35.H37/1992

“Amino Acids and Peptide Synthesis”, (2002) by John Jones; Oxford Chemistry Primer QD431.J623 2002

http://www.vanderbilt.edu/AnS/Chemistry/Rizzo/chem224/chem224.htm

“Introduction to Organic Spectroscopy”, (1996) by Laurence M. Harwood and Timothy D. W. Claridge; Oxford Chemistry Primer QD272.S6.H37

Suggested Reading for Spectroscopic Identification of Organic Compounds

“Structural identification of organic compounds with spectroscopic techniques” (2005) Yong-Cheng Ning QD272.S6 N56

“Introduction to spectroscopy: A guide for students of organic chemistry” 2001 Donald L. Pavia, Gary M. Lampman, George S. Kriz QD272.S6.P38 2001

“Practical spectroscopy: The rapid interpretation of spectral data: For McMurry's Organic Chemistry, fifth edition” 2000 Paul R. Young QD95.Y68

Summaries of lecture material, lecture guides or directions to web-based material may also be provided.

You can find a number of textbooks with “Organic Chemistry” in the title in the University library. All cover similar material, but often use different notation. You may find that some of these other books explain certain topics more clearly.

There also many web resources, but material placed on the web is not necessarily checked for accuracy, so be careful when using it.

Technology Used and Required

You must regularly check the unit web page for course related information. The web page for this unit can be found at: http://ilearn.mq.edu.au

Teaching and Learning Strategy

Lectures will be presented as a combination of formal lectures and interactive tutorial sessions.

Most of the lecture material will be available on the unit website, while there will be some provided in the lecture class. Historically, non-attendance at lectures has a much more deleterious effect that is ultimately reflected in exam performance. It is your responsibility to manage your own study/work/life balance. Circumstances such as routine demands of employment/financial need or extra-curricular activities, routine family problems, and difficulties adjusting to university life and stress associated with the demands of academic work, are not unforeseeable circumstances beyond your control and should not be used as an excuse to miss a lecture.

You MUST acheive a satisfactory mark in the Final Examinaton to pass this course.

Classes Timetable: Please check www.timetables.mq.edu.au for the official timetable of the unit.

Workshops and Laboratory Work: The total mark allocation for laboratory work is 25%. You must complete this component of the course satisfactorily to be able to pass the unit overall.

Laboratory sessions commence in Week 2.

Before commencing a new experiment you are required to complete the prelab component. This includes completing ALL safety assessments, flowcharts, mechanistic details of the reactions and answering any associated questions. Failure to do so will result in your exclusion from the practical, with consequences for the successful completion of the course. You are advised to read each experiment carefully.

Due Date for Practical Reports: Reports must be submitted no later than 5 pm, usually no later than 7 days after completion of the lab. This generally means that the prac report will be handed in at the next lab session. Penalties for late submission will accumulate at the rate of 10% per day overdue.

Learning and Teaching Activities

Lectures

The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas

Workshops

Students work through problems (that are simliar to those encountered in the mid-session and final examinations) associated with the content of the relevant module

Laboratory Classes

The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising organic chemist are taught

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
- Outline some syntheses of alpha amino acids
- Plan a synthesis of a peptide, requiring protecting and activating groups either in solution or in solid phase synthesis
- Deduce the structure of an unknown peptide given results from chemical and enzymic hydrolysis
- Interpret and predict the mechanism of polar rearrangements
- Plan and carry out a synthesis using a polar rearrangement using a literature method
- Plan and carry out a synthesis or a dipeptide
- Write a report in a scientific format

Assessment tasks

- Practical Reports
- Workshop performance
- Mid-semster Examination
- Final Examination

Learning and teaching activities

- The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas
- Students work through problems (that are simliar to those encountered in the mid-session and final examinations) associated with the content of the relevant module

- The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising organic chemist are taught

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products of rearrangement reactions given the starting material and reagent(s)
- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
- Deduce the structure of an unknown peptide given results from chemical and enzymic hydrolysis
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interpret the results) required for a practising organic chemist are taught

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
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Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products of rearrangement reactions given the starting material and reagent(s)
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Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products of rearrangement reactions given the starting material and reagent(s)
- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
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- The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising organic chemist are taught

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Use modern spectroscopic techniques in the structure elucidation of organic compounds from synthesis and nature
- Have a chemical understanding of carbocation/carbanion stability and reactivity
- Predict the products of rearrangement reactions given the starting material and reagent(s)
- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
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- The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas
- Students work through problems (that are simliar to those encountered in the mid-session and final examinations) associated with the content of the relevant module
- The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising organic chemist are taught

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Deduce a mechanism for a rearrangement reaction given the starting material and product(s)
- Outline some syntheses of alpha amino acids
- Plan a synthesis of a peptide, requiring protecting and activating groups either in solution or in solid phase synthesis
- Deduce the structure of an unknown peptide given results from chemical and enzymic hydrolysis
- Interpret and predict the mechanism of polar rearrangements
- Plan and carry out a synthesis using a polar rearrangement using a literature method
- Plan and carry out a synthesis or a dipeptide
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Assessment tasks

- Practical Reports
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Learning and teaching activities

- The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas
- Students work through problems (that are simliar to those encountered in the mid-session and final examinations) associated with the content of the relevant module
- The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising organic chemist are taught

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning and teaching activities

- The theory associated with the unit content is presented, including examples of how to approach problems encountered in the relevant areas
- The practical and report writing skills (including how to plan a synthetic scheme and interpret the results) required for a practising organic chemist are taught