Course Outline

CHEM2921

FOOD CHEMISTRY

School of Chemistry

Faculty of Science

Term 1, 2021

Version 1.0 01/01/2021

1. **Staff**

Position	Name	Email	Consultation times and locations	Location
Course Convenor and Lecturer	Dr Anna Wang	anna.wang@unsw.edu.au	By appointment	Room 720 Hilmer Building, or remotely
Lecturer	A/Prof Jason Harper	j.harper@unsw.edu.au	By appointment	Room 223 Dalton Building, or remotely
Lecturer	Dr Siobhán Wills	siobhan.wills@unsw.edu.au	By appointment	Room 130 Dalton Building, or remotely

2. Course information

Term offered: Term 1

Units of credit: 6

Pre-requisite(s): CHEM1011, 1811, 1031, or 1051, and CHEM1021, 1821, 1041, or 1061.

Teaching times and locations: http://timetable.unsw.edu.au/2021/CHEM2921.html

Component	Day	Time	Location
Lecture 1	Monday	12 – 1 pm	Online via BB collaborate
Lecture 2	Wednesday	1 – 2 pm	Online via BB collaborate
Lectures 3 and 4	Friday	10 – 11 am 12 – 1 pm	Online via BB collaborate
Laboratory Class 1	Monday	2 – 6 pm	Room 262, F10 Chemical Sciences Building
Laboratory Class 2	Tuesday	9 am – 1 pm	Room 262, F10 Chemical Sciences Building

2.1 Course summary

This course covers the chemical structures and properties of protein, carbohydrate, lipids, minerals, and vitamins, and their functions in food systems. It also covers the principles of chemical and instrumental techniques for the qualitative and quantitative analysis of food composition. The laboratory sessions focus on analysis of major and minor food nutrients, and data interpretation.

2.2 Course aims

This course is designed for students enrolled in food science programs. It aims to provide an introduction to the chemistry of water, spectroscopy, amino acids, proteins, fats, carbohydrates, vitamins and minerals. Laboratory work includes proximate analysis of the major food groups, together with specialised analyses such as reducing-sugars, saponification value, iodine value, polarimetry, GLC of fatty acid esters and HPLC of antioxidants.

2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Describe the relationships between food and vitamins, minerals, fats, lipids, and carbohydrates
2. Explain how measurements are taken to evaluate food stability and content
3. Describe the role carbohydrates play in food and how structural changes impact in their activity
4. Understand the role of proteins and vitamins in the body and subsequent chemical transformations that occur to proteins and vitamins during food preparation.
5. Describe the structures, reactions of lipids and fatty acids, and how they impact the body's function

2.4 Relationship between course and program learning outcomes and assessments

Course Learning Outcome (CLO)	LO Statement	Program Learning Outcome (PLO)	Related Tasks & Assessment
CLO 1	Be able to describe the relationships between food and vitamins, minerals, fats, lipids, and carbohydrates	1.1, 2.2	
CLO 2	**Section A: water and spectroscopy** Describe the structure of water and ice. Understand relative vapour pressure, water activity, moisture sorption isotherms, and use these concepts to evaluate food stability in real-world scenarios. Understand elementary spectroscopy, including UV-visible absorption (electron excitation), infrared (vibrational), and fluorescence (emissive) spectroscopy, their limitations and instrumentation.	2.1. 2.2 3.2 3.3 5.1	Lab experiments In-term test Final exam

CLO 4	**Section B: amino acids, proteins and vitamins** Describe the structural components of proteins including how bonds affect protein 3-D shape. Understand the structures, including stereochemistry of amino acids and their chemical reactivity of amino acids stability, denaturation, Isoelectric point. Describe the water soluble and fat-soluble vitamins that are crucial to a healthy body. Understand the food sources for these vitamins, and the chemical changes that occur to vitamins when foods are processed, heated or left out in the air. Explain optimisation of vitamin retention and vitamin supplementation and methods of vitamin analysis.	1.2 2.2 3.2 3.3 5.1 5.2	Lab experiments In-term test Final exam
CLO 5	**Section C: lipids and fatty acids** Understand the structures of carboxylic acid derivatives and apply a knowledge of carboxylic acid derivative reactions such as esterification, ester hydrolysis, and hydrogenation to predict products. Understand lipid and fatty acid nomenclature and be able to draw their structures. Describe the physical and chemical properties of lipids and fatty acids including melting point, polymorphism, auto- and photooxidation and enzyme-related reactions, and thermal decomposition. Understand and explain the mechanisms by which antioxidants function. Analyse and explain methods and results for fat analysis including fat extraction, iodine value, saponification value, fatty acid composition by GC-MS and LC-MS, and measurements of oxidation Be able to analyse and evaluate real-world problems using the knowledge of lipids and fatty acids gained in this course.	3.1 3.2	Lab experiments In-term test Final exam

CLO 3	**Section D: Carbohydrates** •Be able to draw carbohydrate structures and understand the impact of stereochemistry and mutarotation •Describe the difference between reducing/non-reducing sugars, monosaccharides, oligosaccharides, polysaccharides •Explain the role of sugars in starch, vegetables, and dietary fibers •Draw reactions showing the interconversion of alcohols, aldehydes/ketones and carboxylic acids, as well as addition and condensation reactions of aldehydes, ketones, acetal and ketal formation, reaction mechanisms relating to oxidation of organic compounds, and their application to carbohydrate chemistry. •Describe the Maillard and caramelisation reactions, and their reaction products. Understand the relevance of inhibiting non-enzymatic browning and how this impacts colour and flavour of foods; methods of carbohydrate analysis including polarimetry, reducing sugar, and fibre.	1.2 2.1 2.2 3.2 4.1 5.1 5.2	Lab experiments In-term test Final exam

3. Strategies and approaches to learning

3.1 Learning and teaching activities

The course will consist of a total of 34 x 1 hr lectures, 2 x 1 hr in-term tests, and 8 x 4 hr laboratory classes.

Section A will have 6 x 1 hr lectures

Section B will have 8 x 1 hr lectures

Section C will have 9 x 1 hr lectures

Section D will have 11 x 1 hr lectures

Practice: Engaging
The lecture and practical components of the course enable effective learning. The students actively engage in the learning process and are supported by a climate of inquiry where students are appropriately challenged, and activities are linked to research and scholarship.

Strategy: Contextualise
Students become engaged with the learning process when they see the relevance of their studies to the professional and disciplinary contexts. These will occur by linking the lab and lectures.

Strategy: **Design**
The quality and skills required for producing an educated student is done so by effectively teaching students in the context of their interest and discipline. Clearly articulated expectations, goals, and learning outcomes and course requirements increase student motivation and improve learning.

Strategy: **Teaching**
Learning cooperatively with peers as well as learning individually will help students develop their discipline-based knowledge as well as interpersonal and communication skills.

3.2 Expectations of students

Students are expected to attend lectures (4 h / week) and gain a solid theoretical understanding of the topic. They are also expected to submit lab reports after attending in-person and online laboratory classes (4 h / week). Failure to meet minimum requirements (7/8 reports submitted) could result in failure of the course.

4. Course schedule and structure

This course consists of 68 hours of class contact hours. As this is a 6 Unit of Credit course you are expected to require approximately an additional 80 hours of non-class contact hours to complete assessments, readings and exam preparation.

Week [Date/Session]	Topic [Module]	Activity [Learning opportunity]	Related CLO
Week 1	**Section A:** Water and spectroscopy 4 x 1 hr lectures	4 x 1 hr lectures; 1 x 4 hr lab	1, 2
Week 2	**Section A:** Spectroscopy 2 x 1 hr lectures **Section B:** Amino acids and proteins 2 x 1 hr lectures	4 x 1 hr lectures; 1 x 4 hr lab	1, 2, 3
Week 3	**Section B:** Amino acids and proteins 4 x 1 hr lectures	4 x 1 hr lectures; 1 x 4 hr lab	1, 3
Week 4	**Section B:** Amino acids and proteins 2 x 1 hr lectures **Section C:** Fats and oils 1 x 1 hr lecture	3 x 1 hr lectures; 1 x 4 hr lab 1 x 1 hr in-term test **Mon 8 March** (Topics A and B)	1, 3
Week 5	**Section C:** Fats and oils 4 x 1 hr lectures	4 x 1 hr lectures; 1 x 4 hr lab	1, 3, 4
Week 6	**Flexibility week**	No lectures or laboratory in this course	
Week 7	**Section C:** Fats and oils 4 x 1 hr lectures	4 x 1 hr lectures; 1 x 4 h lab	1, 4
Week 8	**Section D:** Carbohydrates 4 x 1 hr lectures	4 x 1 hr lectures; no lab (Easter)	1, 4, 5
Week 9	**Section D:** Carbohydrates 4 x 1 hr lectures	4 x 1 hr lectures; 1 x 4 h lab 1 x 1 hr in-term test **Mon 12 April** (Topics C and D)	1, 5
Week 10	**Section D:** Carbohydrates 4 x 1 hr lectures	3 x 1 hr lectures; 1 x 4 h lab	1, 5

5. Assessment

5.1 Assessment tasks

Assessment task	Length	Weight	Mark	Due date
Assessment 1: Midsession test	1 hr	15	100	Week 4 (Monday)
Assessment 2: Midsession test	1 hr	15	100	Week 9 (Monday)
Assessment 3: Final Exam	2 h	40	100	Exam period
Assessment 4: Laboratories There is a lab class that runs weeks 1-5, 7, 9, 10 of term. This aspect of the course is continuously assessed. Students are expected to submit a report for each experiment and they each contribute an equal amount towards the final laboratory grade (12.5% of the 30% laboratory component	4 h /week	30	100	Weeks 1-5, 7, 9, 10

Important note: To be awarded a pass in this subject, students must satisfy two conditions:

(i) An overall pass (≥ 50%) in the laboratory component, and
(ii) Satisfactory overall performance (≥ 35%) in the final examinations (all four modules combined)
(iii) A minimum attendance of at least 7 laboratories, and submission of 7 reports.

Failure to satisfy both criteria could result in either a FL or UF (Unsatisfactory Fail) grade being awarded, or further assessment being offered at the discretion of the course coordinator and the School Examiners Committee. Students must ensure their availability to attend any supplementary examination that will be offered in the week suggested by UNSW (24 – 28 May 2021); inability or failure to attend a supplementary examination may lead to a FL or UF (Unsatisfactory Fail) grade being confirmed.

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

5.2 Assessment criteria and standards

Midsession tests (2 x 1 hr in weeks 4 and 9): The test will be composed of multiple choice and short answer questions. Correct answers to midsession tests will demonstrate knowledge and understanding of content theory within course material.

Laboratory: Satisfactory completion of ALL core lab skills including maintaining an appropriate lab notebook each week, satisfactory complete of laboratory assessment items including 8 laboratory reports. Marking rubrics will be available on MOODLE.

Final Exam: The test will be composed of short answer questions. Answers to exam questions given correctly will demonstrate knowledge and understanding of course material. Examples of previous Final exam questions will be provided on MOODLE.

5.3 Submission of assessment tasks

Practical reports must be submitted before **one week** after the allocated experiment time.

Please ensure your submission is clearly dated and you include a signed cover sheet.

Late submissions will be subject to a penalty of 10% per day or part thereof. Reports submitted later than 5 calendar dates after the submission date will not be graded although feedback will be given on laboratory reports. Extensions for any assessment item will require application for Special Consideration through the UNSW formal channels.

5.4. Feedback on assessment

- Feedback on in-term tests will be given within two weeks of the test date (tests held in Week 4 and Week 9).
- Feedback on laboratory reports will be given the week following submission.
- Feedback on any online quizzes and associated assessment tasks will be received immediately on completion of these tasks.

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.[1] At UNSW, this means that your work must be your own, and others'

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

7. Readings and resources

Food, The Chemistry of its Components *by T.P. Coultate 4th or 5th Edition*

Analytical Chemistry of Foods *by C.S. James 1st Edition, 1995*

Supplemental Lecture material may be distributed by individual lecturers.

8. Administrative matters

Occupational Health and Safety	Information on relevant Occupational Health and Safety policies and expectations at UNSW: https://safety.unsw.edu.au/ School of Chemistry OH&S policy and requirements see laboratory manual and Moodle. To be admitted to a laboratory, you must wear safety glasses, a lab coat and covered shoes (no thongs, open sandals or clogs). You must also complete all safety pre-lab work, risk assessment or other prescribed preparation relating to carrying out safe laboratory work. Visitors are not allowed to undergraduate laboratories without the permission of the lab supervisor.		
Assessment Procedures **UNSW Assessment Policy**	Important note that the standard assessment procedures for chemistry are as follows: To be awarded a pass in this subject, students must satisfy three conditions: (i) An overall pass (≥ 50%) in the laboratory component; (ii) Satisfactory overall performance (≥ 35%) in the final exam; (iii) A minimum attendance of 90% in laboratories is required (7 out of 8 laboratories). Failure to satisfy these criteria could result in either a FL or UF (Unsatisfactory Fail) grade being awarded, or further assessment being offered at the discretion of the course coordinator and the School Examiners' Meeting, according to UNSW Procedures. Students must ensure their availability to attend any supplementary examination that will usually be offered in the week suggested by UNSW (24 – 28 May 2021); inability or failure to attend a supplementary examination may lead to a FL or UF (Unsatisfactory Fail) grade being confirmed.		
Equity and Diversity	Those students who are living with a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to, or at the commencement of, their course, or with an Advisor in the Equitable Learning Services Unit (https://student.unsw.edu.au/els). Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.		
Student Complaint	**School Contact**	**Faculty Contact**	**University Contact**

Procedure	A/Prof John Stride Director of Teaching j.stride@unsw.edu.au	A/Prof Alison Beavis Deputy Dean (Education) sci.dde@unsw.edu.au Tel: 9385 0752	Student Conduct and Integrity unit. https://student.unsw.edu.au/complaint Telephone 02 9385 8515, email studentcomplaints@unsw.edu.au University Counselling and Psychological Services https://student.unsw.edu.au/counselling/ Tel: 9385 5418

Further information about academic integrity and **plagiarism** can be located at:

- The *Current Students* site https://student.unsw.edu.au/plagiarism, and
- The *ELISE* training site https://subjectguides.library.unsw.edu.au/elise

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing
- Equitable Learning Services: https://student.unsw.edu.au/els
- UNSW IT Service Centre: https://www.myit.unsw.edu.au/