Biochemistry and molecular biology

A specialisation in biochemistry and molecular biology is an important requirement for employment in many biomedical, biotechnological and agricultural fields. The acquisition of basic knowledge in biochemistry and molecular biology is also an important requirement for the training of specialist scientists in a broad range of biological fields. Consequently, biochemistry and molecular biology 521-211, 521-212 and 521-220 are central subjects in the BSc courses for many students seeking careers as botanists, geneticists, histologists, microbiologists, pharmacologists, pathologists, physiologists and zoologists. Students specialising in chemistry, physics, mathematics, computer science and chemical engineering can enhance the biological aspects of their studies by taking biochemistry and molecular biology courses. The combination of chemistry with biochemistry and molecular biology 521-211 and 521-212 is a particularly useful one. For students wishing to specialise in the field of macromolecular structure and bioinformatics, biochemistry and molecular biology 521-307 will be of special interest.

Biological science streams, suggested subjects

For students in the biological science streams planning to include biochemistry and molecular biology subjects in their studies:

100-level subjects

- biology 650-141 plus 650-142
- chemistry 610-122 or 610-142 plus its chemistry prerequisite
- 620-160 Experimental Design and Data Analysis
- 620-161 Introductory Mathematics A, 620-141 Mathematics A, or 620-121 Mathematics A (Advanced)
- physics: 25 points at 100-level

200-level subjects

Students intending to proceed to 300-level biochemistry and molecular biology should take biochemistry and molecular biology 521-211, 521-212 and 521-220. The most useful combinations of subjects from other disciplines with biochemistry and molecular biology are set out in Table 1. Students are advised that 200-level chemistry is particularly useful for the study of biochemistry and molecular biology; if only two subjects of 200-level chemistry are to be taken, the preferred subjects are 610-210 and 610-260, or 610-220 and 610-260. If only one 200-level chemistry subject is taken, it should be 610-260.

Table 1: Suggested 200-level subjects	
Anatomy and cell biology	516-201, 516-204, 516-207, 516-209
Botany	606-201, 606-202, 606-205
Chemistry	610-210, 610-220, 610-240, 610-260
Genetics	652-214, 652-215, 652-216
Microbiology and immunology	526-201, 526-205
Pathology	531-201
Pharmacology	534-201
Physiology	536-201, 536-202, 536-203, 536-211
Zoology	654-201, 654-202, 654-203, 654-204

300-level subjects

Students intending to specialise in biochemistry and molecular biology should enrol in at least three of the six lecture subjects and in at least one of the practical subjects 521-321 and 521-322. Fifty points taken in this way ensures that a major in biochemistry can be credited (enrolment in one practical subject is mandatory).

Note that students undertaking one or more 300-level practical subject must have passed 521-220.

300-level subjects in other disciplines that are appropriate adjunct studies to a major in biochemistry and molecular biology are listed in Table 2. For model enrolments satisfying the faculty requirements for a major see <http://www.biochemistry.unimelb.edu.au/bch/teaching/advice.htm>.

Table 2: Suggested 300-level subjects	
Anatomy and cell biology	516-302, 516-304, 516-305, 516-306
Botany	606-301, 606-302, 606-303, 606-306
Chemistry	610-310, 610-320, 610-332, 610-360
Genetics	652-301, 652-302, 652-303, 652-304, 652-305, 652-306
Microbiology and immunology	526-301, 526-302
Pathology	531-301, 531-302, 531-303, 531-304, 531-305
Pharmacology	534-301, 534-302, 534-304, 534-305, 534-306
Physiology	536-301, 536-302, 536-303, 536-304, 536-308
Zoology	654-302, 654-303, 654-304, 654-305, 654-306, 654-307

Students wishing to proceed to BSc (Honours) in the Department of Biochemistry and Molecular Biology should normally undertake at least 50 points of biochemistry and molecular biology at 300-level. Students wishing to proceed to a combined BSc (Honours) course in chemistry and biochemistry and molecular biology should seek advice from the individual departments on undergraduate course selections.

Biotechnology

The 300-level biochemistry and molecular biology lecture subjects 521-301, 521-302, 521-303 and 521-307 are of particular relevance to those intending to pursue a career in the biotechnology field. Both practical subjects 521-321 and 521-322 are relevant, depending on the areas of specific interest. Students interested in subjects that emphasise biochemical aspects of biotechnology should consult the Graduate Diploma in Biotechnology entry in the Postgraduate Handbook and seek further advice from the department.

Bachelor of Science (Degree with Honours)

For information about the faculty and departmental entry requirements for honours, please refer to *Bachelor of Science (Degree with Honours) and Bachelor of Information Systems (Degree with Honours) (p.1)*. These requirements should be considered when planning your course.

Further information

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Subject descriptions

200-level subjects

521-204 Biochemistry and the Eye

Note: This subject is only available to students enrolled in the Bachelor of Optometry course.

Credit points: 12.5

Coordinator: Mr G Parslow; Dr A Gentle

Prerequisites: Biology and chemistry are required for entry into studies for the Bachelor of Optometry.

Contact: 42 hours of lectures and six tutorials *(Semester 1)*.

Description: The objectives are to develop an understanding of the chemical properties and functions of body constituents, metabolic and regulatory processes, particularly in relation to the eye and other tissues which have a major influence on the function and maintenance of the eye. The first part of this suject is core biochemistry and then progresses to specific interactions within the eye. You will be introduced to the biochemical basis of diseases of the eye; and the role of experimentation in the development of biochemical knowledge and the clinical relevance of ocular biochemistry and molecular biology. Major topics are the structure, function and metabolism of proteins, carbohydrates, lipids, mucopolysaccharides and nucleic acids; specialised functions of proteins, lipids and proteoglycans, bioenergetics, ion transport, DNA replication, the genetic code, messenger RNA, protein synthesis at ribosomes; the function, composition, and production of tears and aqueous humour; the extracellular matrix of the cornea, sclera and vitreous humour; the ion channel mechanisms of the retina, lens, cornea and ciliary body; the visual cycle in the retina, through from the genetic components of the photopigments to the biochemistry of the phototransduction cascade and retinal metabolism.

Assessment: A 1-hour multiple choice test held mid-semester (10%); a 3-hour written examination in the examination period (90%).

521-211 Biochemistry & Molecular Biology Part A

Note: Not available to students enrolled in the BBiomedSc.

Credit points: 12.5

Coordinator: Dr I Stanley

Prerequisites: Chemistry 610-122 or 610-142 (plus their chemistry prerequisite). Biology 650-141 plus 650-142 are strongly recommended.

Contact: 36 lectures (three a week); 12 hours of computer-based tutorials *(Semester 1).*

Description: Biological macromolecules, including proteins, nucleic acids, lipids and carbohydrates, provide the molecular basis for all living systems. To understand these systems we must understand the structures, functions and chemical properties of these macromolecules. Content includes an introduction to the principles of cellular functions; amino acid chemistry; structure and function of proteins with particular attention given to haemoglobin and immunoglobulins; properties of enzymes and their regulation; carbohydrate structure and function; the structure of nucleic acids and their role as genetic material, including DNA replication and repair; the composition of chromosomes and genes and bioinformatical approaches for analysing the structure of genes; lipid chemistry; cell membrane composition, dynamics and function including membrane transport processes; the molecular architecture of the cell.

In addition to specific skills gained through the study of biochemistry and molecular biology, students should develop the following generic skills:

- the ability to think critically and organise knowledge, from consideration of the lecture material;
- the ability to learn to adopt new ideas, from participation in the lecture program; and
- the ability to plan effective work schedules and grow more confident in the synthesis of knowledge.

Assessment: Ongoing computer-based assessment during the semester (10%); a 40-minute multiple choice examination held mid-semester (10%); a 3-hour written examination in the examination period (80%)

521-212 Biochemistry & Molecular Biology Part B

Note: Not available to students enrolled in the BBiomedSc.

Credit points: 12.5

Coordinator: Dr I Stanley

Prerequisites: Biochemistry 521-211.

Contact: 36 lectures (three per week); 12 hours of computer-based tutorials *(Semester 2).*

Description: Gene expression and metabolism provide cells with the proteins and macromolecules that are essential to carry out their life processes. In this course, metabolic processes will be seen as the outcome of gene expression and regulation, by factors within and external to cells. While we investigate these processes, we achieve an understanding of contemporary work in genomics, proteomics and metabolomics.

The content includes expression, transcription and translation of genes to yield functional proteins; regulation of gene expression; function and regulation of pathways for the catabolic and anabolic metabolism of carbohydrates, lipids and nitrogen-containing compounds in mammalian cells; bioenergetics and mitochondrial function; photosynthesis and carbon fixation. An introduction to the field of signal transduction explores the actions of hormones and their intracellular signalling pathways, critical to health and disease.

The subject is appropriate for all with interests in fundamental research, biotechnology and bioinformatics. This core subject continues from 521-211 as a foundation for a career in the life sciences and is also a frequent choice for double degree students.

In addition to the specific skills gained through study of biochemistry and molecular biology, students should develop the following generic skills:

- the ability to think critically and organise knowledge, from consideration of the lecture material;
- the ability to learn to adopt new ideas, from participation in the lecture program; and
- the ability to plan effective work schedules and grow more confident in the synthesis of knowledge.

Assessment: Ongoing computer-based assessment during the semester (10%); a 40-minute multiple choice examination held mid-semester (10%); a 3-hour written examination in the examination period (80%)

521-220 Techniques in Protein & Gene Technology

Note: Not available to students enrolled in the BBiomedSc.

Before the commencement of the semester, students must advise the Department of Biochemistry and Molecular Biology of their order of preference for the alternative practical sessions and the other subjects they will be taking.

Credit points: 12.5

Coordinator: Dr L Helfenbaum

Corequisites: Biochemistry 521-211.

Contact: 12 lectures (one per week), 36 hours of practical work (three hours per week), 12 hours of computer-assisted learning and 12 tutorials (1 hour per week) *(Semester 1, repeat 2).*

Description: This is a skills subject suitable for students taking life science subjects and combined degrees. Its focus is primarily on the development of practical skills in the laboratory and the understanding of techniques employed in biochemistry to investigate biological problems. This subject should be undertaken by students considering any third-year level study in life science. The subject is a specific prerequisite for most subjects offered by the Department of Biochemistry and Molecular Biology in third year. The subject is conceptually organised into three major divisions:

- basic skills, experimental accuracy and data interpretation;
- separation and handling of proteins; and
- separation and handling of nucleic acids.

The lectures will provide a summary of the theory of both classic laboratory techniques and the latest methodology that are central to research progress in biochemistry and molecular biology. The new technologies to be described are driving the emerging fields of genomics and proteomics. Progress in research is predicated not only on asking appropriate questions, but on having the laboratory support and skills to investigate those questions. Students will be able to develop skills of preparation, execution and interpretation of laboratory procedures by performing:

- chromatographic separation of small and large biological molecules;
- quantitation of macromolecules;
- determination of kinetic parameters of a glycolytic enzyme;
- purification of the enzyme lysozyme;
- purification and characterisation of chromosomal and plasmid DNA;
- restriction mapping of the lambda phage genome;
- polymerase chain reaction to amplify DNA of interest;
- interrogation of computer databases in life sciences.

Students will learn to relate theoretical principles to practical explanations, through observing and reporting on practical work.

Assessment: Ongoing computer-based assessment during the semester (5%); written reports of experiments and related exercises due after the completion of each activity (50%); a 1-hour laboratory practical test during the semester (10%); a 50-minute written test held mid-semester (5%); a 2-hour written examination in the examination period (30%).

300-level subjects

521-301 Protein Structure, Design & Engineering

Credit points: 12.5

Coordinator: A/Prof G Howlett

Prerequisites: Biochemistry 521-211, 521-212 and 521-220.

BBiomedSc students: 521-213 and 536-250.

Contact: 36 lectures (three per week) *(Semester 1).*

Description: By the end of the subject, the student should have developed an appreciation of the impact of structural biology on biomedical research and biotechnology, and also an understanding of the structural properties of proteins. The subject matter addresses how proteins fold in vivo and in vitro; how protein design and engineering is used for investigating structure-function relationships; and the challenges of producing recombinant proteins for pharmaceutical and industrial applications. The theoretical background to the major techniques used in modern protein chemistry and their applications in biotechnology will also be covered. The following topics will be presented: general properties of protein structure; the major classes and topologies of proteins; evolution of sequence, structure and function; protein folding and molecular chaperones; protein design for biotechnology; designing proteins de novo; computer-based prediction of protein fold; binding of small molecules to proteins and drug design; protein-protein interactions; transcription factors and their interactions with DNA; effects of point mutations on tertiary structure, protein stability and biological functions; and enzyme reaction kinetics. Examples from the classical and current scientific literature will include immunoglobulins and the use of molecular scaffolds, phage display and DNA shuffling techniques, amyloid fibrils and disease, transcription factors and protein mediators of signal transduction.

In addition to these specific skills, students will think critically from consideration of the lecture material and research papers, expand from theoretical principles to practical explanations through observing and reporting research literature and acquire abilities in collaborative working, while participating in group presentations.

Assessment: Two 30-minute written tests held during semester (10% total); a 15-minute oral presentation or a written assignment of up to 1500 words

during the semester (10%); a 3-hour written examination in the examination period (80%).

Prescribed texts: C Branden and J Tooze, *Introduction to Protein Structure*, 2nd edn, Garland, 1998.

521-302 Functional Genomics

Credit points: 12.5

Coordinator: A/Prof I R van Driel

Prerequisites: Biochemistry 521-211, 521-212 and 521-220.

Other combinations that provide similar background will be considered by the coordinator.

BBiomedSc students: 521-213 and 536-250.

Contact: 36 lectures (three per week) *(Semester 2)*.

Description: By the end of the subject, the student should have developed a detailed understanding of current concepts concerning the molecular bases of genome structure and the regulation of gene expression in eukaryotic organisms (yeast, animals and plants); a theoretical background to recombinant DNA technology and an appreciation of its biomedical and biotechnological applications; an appreciation of the significance and applications of human and related genome sequencing programs; and the ability to read critically original scientific literature in the field. Subject content includes structure of genes and chromosomes; identification and functional characterisation of candidate genes for human familial disease; molecular aspects of transcription and RNA maturation; regulation of gene expression at the transcriptional and translational levels; gene expression profiling and proteomics; ribosome biogenesis as a major example of the coordination of gene expression and RNA processing; biochemistry and molecular biology of cell cycle control and carcinogenesis; proto-oncogenes and tumour suppressor genes; ribozymes and the catalytic and antisense functions of RNA; applied genomics; and recombinant DNA technology, including recombinant protein expression systems with particular reference to investigations based on transfected cell culture, transgenic and gene knockout systems.

In addition to these specific skills, students will think critically from consideration of the lecture material and research papers, expand from theoretical principles to practical explanations through observing and reporting research literature, and acquire abilities in collaborative working while participating in group presentations.

Assessment: A 15-minute group oral presentation or a 1500 word written assignment during the semester (10%); two 45-minute multiple choice examinations during the semester (5% each); a 3-hour written examination in the examination period (80%).

Prescribed texts: B Alberts et al, *Molecular Biology of the Cell*, 4th edn, Garland, 2001. **or** H Lodish et al, *Molecular Cell Biology*, 4th edn, Scientific American Books, 2000.

521-303 Molecular Aspects of Cell Biology

Credit points: 12.5

Coordinator: A/Prof T Lithgow

Prerequisites: Biochemistry 521-211, 521-212 and 521-220.

Other combinations that provide a similar background will be considered by the coordinator.

BBiomedSc students: 521-213 and 536-250.

Contact: 36 lectures (three per week) *(Semester 1)*.

Description: To complement the information explosion of the new genomic era, it is essential to appreciate the cellular architecture of cells and how the delivery of proteins to their correct locations in the cell is crucial for the complex intracellular signalling pathways that control cell morphology, organisation and behaviour.

Topics covered include compartmentalisation in eukaryotic cells; intracellular RNA and protein traffic; the molecular structure, function and biogenesis of subcellular organelles; protein folding and maturation; vesicle-mediated transport; structure and function of the extracellular matrix and cell adhesion molecules and their role in diseased states such as malignancies; cellular stress responses and linked signal transduction events; cytoskeletal structures and the signal transduction processes regulating the assembly and disassembly of actin-cytoskeleton; molecular processes determining cell movement and shape changes; imaging of processes within live cells.

Students should acquire an understanding of the relationships between molecular design, cellular organisation and biological function of normal, stressed and malignant eukaryotic cells, as well as detailed knowledge of the major experimental strategies for investigating the molecular basis of these relationships.

In addition to these specific skills, students will think critically from consideration of the lecture material and research papers, expand from theoretical principles to practical explanations through observing and reporting research literature, and acquire abilities in collaborative working while participating in group presentations.

Assessment: Two 1-hour multiple choice tests during the semester (5% each); a 10-15 minute group oral presentation during the semester (5%); a 1000-word written assignment due during the semester (5%); a 3-hour written examination in the examination period (80%).

Prescribed texts: B Alberts et al, *Molecular Biology of the Cell*, 4th edn, Garland, 2002. **or** H Lodish et al, *Molecular Cell Biology*, 5th edn, Scientific American Books, 2004.

521-304 Hormone & Neurotransmitter Biochemistry

Credit points: 12.5

Coordinator: A/Prof B Livett; Dr H-C Cheng

Prerequisites: Biochemistry 521-211 and 521-212.

BBiomedSc students: 521-213 and 536-250.

Contact: 36 lectures (three per week) *(Semester 2)*.

Description: Aberrations in the structure and expression of hormones, growth factors, neurotransmitters and their receptors can give rise to diseases such as diabetes, cancer and Parkinson's disease. To understand the molecular basis of these diseases, it is essential to know how hormones, growth factors and neurotransmitters are synthesised and processed, and how their signals are recognised, amplified and transmitted by intracellular signaling pathways in the target cells.

On completion of the subject, students will understand the molecular basis of hormone and neurotransmitter actions; the techniques used to investigate the mechanism of hormone action and neurotransmitter functions; and how abnormalities in synthesis and secretion and in the intracellular signalling pathways give rise to diseases.

Topics covered include endocrine systems producing individual hormones; biosynthesis, storage and secretion of hormones and neurotransmitters; hormone receptors and mechanisms of intracellular signal transduction, emphasis on second messengers and protein phosphorylation-dephosphorylation; regulation of gene expression; molecular basis of insulin action and drug addiction; tissue specialisation within the nervous system and different roles of individual neurotransmitters; neurochemistry of visual transduction; neurochemistry of myelin; molecular basis of multiple sclerosis, Parkinson's, Huntington's, Alzheimer's and other neurological diseases.

In addition to these specific skills, students will think critically from consideration of the lecture material and research papers, expand from theoretical principles to practical explanations through observing and reporting research literature, and acquire abilities in collaborative working while participating in group presentations.

Assessment: A 50-minute written test held mid-semester (7.5%); a 50-minute written test at the end of semester (7.5%); a 50-minute group oral presentation during semester (5%); a 3-hour written examination in the examination period (80%).

521-305 Biochemistry of Metabolism & Nutrition

Credit points: 12.5

Coordinator: Dr A Mitchell

Prerequisites: Biochemistry 521-211, 521-212 and 521-220. In special circumstances students who have not taken 521-220 may be permitted to enrol in this subject.

BBiomedSc students: 521-213 and 536-250.

Contact: 36 lectures (three per week) *(Semester 1)*.

Description: An understanding of the molecular mechanisms that control metabolic processes and determine metabolic outcomes is needed for interpretation of, and appropriate responses to nutritional information.

On completion of the subject, students should understand the relationships between nutrients and metabolic processes in various physiological and diseased states.

The subject content includes an overview of whole animal nutrition and metabolism; the principles behind control of nutrient digestion and absorption; the concepts of bioenergetics and the consequences of aerobic metabolism, including the generation of free-radicals and the importance of antioxidants in protecting proteins, lipids and DNA from oxidative damage; the mechanism of action of lipid-soluble vitamins; the regulation of muscle protein metabolism in response to starvation, physical trauma and various diseases; the dietary fate of lipids; the regulation of lipoprotein metabolism and transport in normal and disease states; metabolic contributions to obesity, cardiovascular disease, aging and related nutritional problems; nutrient carrier proteins and relevant cell receptors.

In addition, students will develop skills in critical thinking from consideration of both the lecture material and research literature. They will learn to apply theoretical principles to the explanation of observations and acquire skills in communication, time management and collaborative working through participation in group presentations.

Assessment: A 30-minute group oral presentation and 1000 word written assignment during the semester (10%); a 45-minute written test held mid-

semester (10%); a 3-hour written examination in the examination period (80%).

521-307 Biomolecular Structure & Bioinformatics

Credit points: 12.5

Coordinator: A/Prof P Gooley

Prerequisites: 521-301.

BBiomedSc students: 521-213, 536-250 and 521-308.

Contact: 24 lectures (two per week) and 36 hours of practicals and workshops *(Semester 2).*

Description: Students will acquire knowledge of the fundamental concepts of determination of protein and nucleic acid structure, and bioinformatics (computational molecular biology) necessary for those who wish to continue studies in relevant areas of structural biology, bioinformatics, protein engineering and rational drug design. Students will also gain an appreciation of the Human Genome Project and its impact on the developing fields of bioinformatics, structural genomics, protein pharmaceuticals and drug discovery.

This subject gives an overview of the theory and application of methodologies for the determination and computational analyses of macromolecular structures using Nuclear Magnetic Resonance (NMR) spectroscopy, X-ray crystallography, protein molecular dynamics, protein fold recognition, and gene and protein database mining; and the biophysical methods for investigating macromolecular recognition and interaction.

Subject content includes principles and practice of X-ray crystallography and NMR spectroscopy for determining the three-dimensional structures of biomolecular complexes; the application of X-ray crystallography and nuclear magnetic resonance spectroscopy to structural genomics, rational drug design and screening; use of gene and protein databases to detect biologically significant data; biophysical methods for determining the conformations of proteins and nucleic acids in aqueous solution; and molecular dynamics of proteins and the principles of macromolecular recognition including computer-based modelling.

In addition to the specific skills gained through study of this subject, students should develop problem-solving and communication skills in tutorials and report writing.

Assessment: Ongoing assessment of practical and laboratory work during the semester (30%); a 2-hour written examination in the examination period (70%).

521-321 Gene Technology & Protein Expression

Note: Before the commencement of the semester, students must advise the Department of Biochemistry and Molecular Biology of their order of preference for the alternative practical sessions and the other subjects they will be taking. (See subject website for details).

Credit points: 12.5

Coordinator: Mrs B Bencina

Prerequisites: Biochemistry 521-211, 521-212 and 521-220.

BBiomedSc students: 521-213 and 536-250.

Contact: 48 hours practical work (four hours a week) plus 12 hours of lectures (one per week) *(Semester 1).*

Description: To participate in the rapidly expanding field of genome research, it is necessary to have an understanding of the techniques for handling both DNA and recombinant proteins. This subject aims to provide both. Students will receive training in the basic laboratory skills for manipulation of DNA and proteins and apply these skills to a number of biotechnological investigations.

Areas covered include the use of recombinant DNA for the investigation of gene function and the use of bacterial expression systems for the production and analysis of recombinant proteins. Specific experiments will deal with PCR, plasmid purification, DNA cloning and sequencing and bioinformatics.

In addition to these specific skills, students will develop an appreciation for the current scientific literature and acquire problem-solving skills through collaborative work.

Students will learn how to maintain a laboratory notebook containing a detailed record of the experiments carried out and prepare written reports describing these experiments.

The experimental work will be organised into elective streams, one of which will involve an opportunity to undertake relevant project work in one of the department's research laboratories (a quota will apply for project work).

The practical unit will be supported by a lecture series addressing current advances in these technologies. Topics include cDNA cloning and sequencing, sequence databases and analysis; recombinant expression systems; protein purification; and immunochemistry.

Assessment: Ongoing assessment of laboratory skills and practical management of the experimental program throughout the semester (30%); a 2-hour written examination in the examination period (30%).

Laboratory course: a written research report of up to 2000 words and a laboratory notebook submitted during the semester (40%).

Project work: maintenance of a laboratory notebook throughout the semester and a written research report of up to 2500 words to be submitted by the end of the semester (40%).

521-322 Protein Biochemistry and Proteomics

Note: Before the commencement of the semester, students must advise the Department of Biochemistry and Molecular Biology of their order of preference for the alternative practical sessions and the other subjects they will be taking. (See subject website for details).

Credit points: 12.5

Coordinator: Mrs B Bencina; A/Prof G Howlett

Prerequisites: Biochemistry 521-211, 521-212 and 521-220.

BBiomedSc students: 521-213 and 536-250.

Contact: 48 hours practical work (four hours a week) plus 12 hours of lectures (one per week) *(Semester 2).*

Description: The subject explores various aspects of protein structure and function using a number of different approaches used in current research. Experiments will be selected from the following - Proteomics, the analysis of protein mixtures to determine protein identity and sequence using mass spectrometry; studies on the catalytic mechanisms of enzyme action; the thermodynamics of protein unfolding and investigations into the binding of small molecules to amyloid fibrils and other proteins of biological and medical interest.

The lecture series will support the practical part of the course providing background information and current advances in the areas of study.

By the end of the subject, the student should have developed skills in experimental methods used in investigations of protein structure and function and in the critical evaluation of the experimental data derived from such experiments. They should also be able to apply these skills in the performance of a number of experiments and in the interpretation of experimental data using appropriate model simulations.

In addition to these specific skills, students will develop an appreciation for the current scientific literature and acquire problem-solving abilities in a collaborative setting.

Students will learn how to maintain a laboratory notebook containing a detailed record of the experiments carried out and prepare written reports describing these experiments. Experimental work may be organised into elective streams, one of which will involve an opportunity to undertake relevant project work within one of the department's research laboratories (a quota will apply).

Assessment: Laboratory skills and practical management of the experimental program throughout the semester (30%); a 2-hour written examination in the examination period (40%).

Laboratory streams: written reports on laboratory experiments due during the semester (30%).

Project stream: a written research report of up to 2500 words due at the end of the semester (30%).