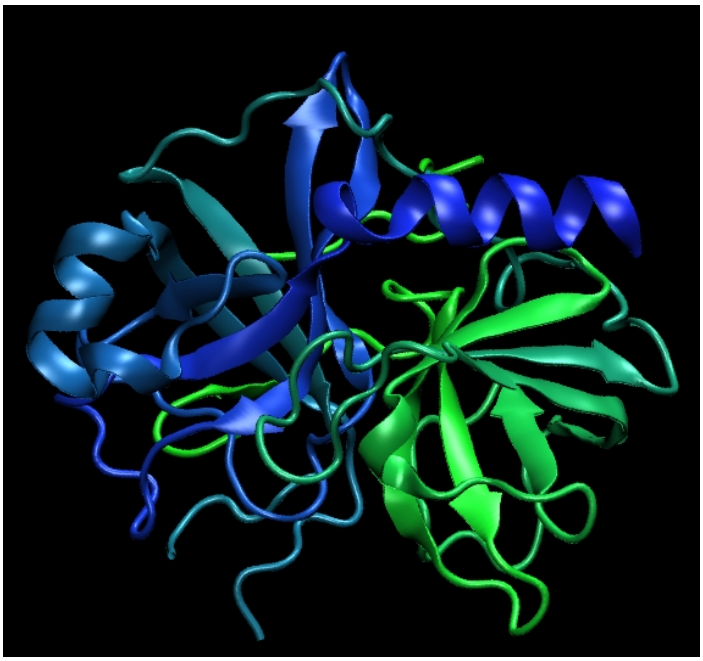
MASSEY UNIVERSITY

Bachelor of Science
Biochemistry

Undergraduate Handbook



Contents

WELCOME

COLLEGE OF SCIENCES
Biochemistry

To all prospective students,

This is an exciting time to be a biochemistry student. The world around us is rapidly changing. The new technologies for working with proteins and metabolic networks have a major influence on how our society is changing and developing. It is important for you to learn about these technologies and the theories that underpin them so that you can play an important role in affecting a process of change in both scientific understanding and human perceptions and attitudes.

Biochemists want to know how biological processes function and how they are controlled at the molecular and cellular level. This basic knowledge is critical for understanding life itself.

I am pleased to welcome you to Massey University. It is up to you to make the most of the many opportunities that we offer. A wide range of undergraduate and postgraduate papers are available to you at Massey University. The undergraduate papers offered in the Biochemistry major are detailed in this booklet. They underpin a wide range of disciplines, from plant and animal physiology, biological chemistry, molecular biology, genetics, health science, human and animal nutrition, to pure biochemistry itself.

A degree in Biochemistry will enable you to have a career in research, teaching or the many biology-based industries as diverse as forensic science, molecular diagnostics, and biotechnology. This degree will also enable you to embark on post-graduate studies.

I welcome your interest in Biochemistry and I hope that you will find your studies with the Massey University staff interesting, useful and enjoyable.

Associate Professor Kathryn M Stowell (PhD)
Subject Leader
Institute of Molecular BioSciences

Introduction

This handbook profiles papers that are of special interest to Biochemistry students, and are taught by the College of Sciences. We have made every attempt to ensure all details are correct. However, all students should note that the Massey University Calendar is the official source of information on courses and regulations.

The discipline of Biochemistry at Massey University consists of six academic staff members. In addition, the group is well supported by several technical and administrative staff. Interests range from protein structure and function, zymology, molecular genetics, molecular biology, cancer genetics, biotechnology, cell biology, and biochemistry to evolution.

Staff in Biochemistry provide postgraduate opportunities with, for example, PGDipSc, Honours, Masters and PhD programmes available. Undergraduate students are eligible to apply for summer studentships that may be offered on an annual basis.

Teaching approach

Undergraduate papers are taught via lectures (usually 3 lectures per week at 100 & 200 level and 2 lectures per week at 300 level) and laboratory classes (usually one 3 hour class per week). Optional tutorials are offered at set times. Students are expected to spend some time in addition to the scheduled learning in reading and preparing for lectures and practical classes. Many papers are web supported. A comprehensive paper outline will be made available to enrolled students at the start of each paper.

The Bachelor of Science degree

Students have to pass 24 (15 credit) papers in total to qualify for a BSc degree. Typically, eight papers have to be passed each year from papers listed in the BSc schedule in the Calendar. Students should ensure that the essential required papers for each major are included in their programme.

In planning your total degree, you can consult the 'Enrolment Science" Handbook, the Massey University Calendar, or contact Associate Professor Kathryn Stowell (contact details p. 7).

Bachelor of Sciences – Major in Biochemistry

Programme Structure

Year 1	
123.101	Chemistry and Living Systems
162.101	Biology of Cells
119.155	Communication in Sciences
122.102	Biochemistry of Cells
161.130	Biometrics
PLUS two other approved papers	
123.102 Chemistry and the Material World is highly recommended	

Year 2	*Year 2*	*Year 2*
OPTION ONE	**OPTION TWO**	**OPTION THREE**
122.231 Genes and Gene Expression	122.231 Genes and Gene Expression	122.231 Genes and Gene Expression
122.233 Metabolic Biochemistry	122.232 Protein Biochemistry	122.232 Protein Biochemistry
162.211 Biology and Genetics of Microorganisms	122.233 Metabolic Biochemistry	122.233 Metabolic Biochemistry
122.232 Protein Biochemistry	123.204 Chemical and Biochemical Analysis	
PLUS four other approved papers.	**PLUS four other approved papers**	**PLUS five other approved papers**
For a list of approved other papers, see p28	**For a list of approved other papers, see p28**	**For a list of approved other papers, see p28**

Year 3	*Year 3*	*Year 3*
OPTION ONE	**OPTION TWO**	**OPTION THREE**
122.322 Protein Structure and Function	122.322 Protein Structure and Function	122.322 Protein Structure and Function
203.300 DNA Technology	122.327 Advanced Biochemistry	122.327 Advanced Biochemistry
203.303 Gene Regulation	203.300 DNA Technology	203.300 DNA Technology
203.307 Advanced Cell Biology **OR**	203.303 Gene Regulation	203.203 Gene Regulation
122.327 Advanced Biochemistry **or**	123.312 Advanced Organic Chemistry **OR**	203.307 Advanced Cell Biology **or**
122.328 Genome Analysis	203.307 Advanced Cell Biology **or**	122.328 Genome Analysis
	122.328 Genome Analysis	
PLUS three other approved papers.	**PLUS three other approved papers.**	**PLUS three other approved papers.**
For a list of approved other papers, see p27	**For a list of approved other papers, see p27**	**For a list of approved other papers, see p27**

Contact details:

Associate Professor Kathryn Stowell
Major Leader Biochemistry
Massey University
Private Bag 11 222
Palmerston North
NEW ZEALAND

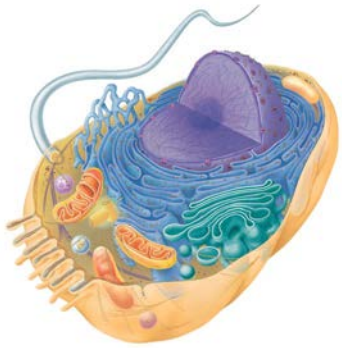
Phone: 64 6 356 9099 ext 7517
Fax: 64 6 350 5688
Email: K.M.Stowell@massey.ac.nz

More Information

Students who intend to take papers offered in Biochemistry and who may wish for more information, should consult the major leader of Biochemistry, Associate Professor Kathryn Stowell. Assoc Professor Kathy Kitson is the Programme Director for the College of Sciences at the Manawatu Campus and can also provide information of a more general nature.

YEAR ONE - Semester 1

162.101 Biology of Cells



Paper Co-ordinator: Assoc Professor Rosie Bradshaw

Learning Outcome: Students who successfully complete this paper will be able to:

1. Identify and describe cellular components and their functions.
2. Demonstrate understanding of how genetic information is inherited, used and controlled in cells.
3. Make connections between different concepts in cell biology.
4. Apply concepts of cell biology and genetics to analyse and draw conclusions from experimental data.
5. Demonstrate understand and correct use of appropriate vocabulary.
6. Design controlled experiments and interpret data.
7. Apply appropriate laboratory techniques to investigate cell biology with due regard to safety.
8. Recognise the importance of cell biology in society and the environment.

Outline: An introduction to eukaryotic and prokaryotic cell structure and function, and the chemistry of life. The flow of information within cells and transmission of genetic information to progeny in cell division. A description of cellular mechanisms for creating genetic diversity and the control of gene expression. An introduction to molecular genetics and genomics.

Pre- requisites: Students will be assumed to have studied at least 20 credits from NCEA Level 3 Biology and achieved at least 14, or passed Bursary Biology or 162.103 or an acceptable alternative.

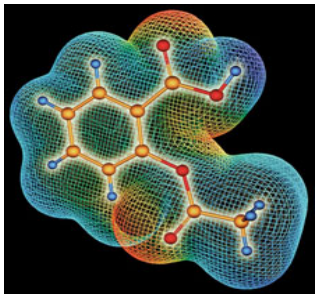
Extramural: Not available extramurally in alternate years.

Assessment:

Online Assignments	10%
Laboratory Assessments	20%
Semester Test	15%
Final Examination	55%

Textbook: Campbell Biology (international version) Reece JB et al. 9thEdition Publisher: Pearson Benjamin Cummings (ISBN 9314994245622)

YEAR ONE -Semester 1



123.101 Chemistry and Living Systems

Paper Coordinator: Dr Gareth Rowlands

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Describe common organic compounds including biologically important molecules such as proteins, carbohydrates, fats and other natural products. Commercially important groups of materials such as polymers, detergents, fuels, dyes, and fragrances will also be considered.
2. Interpret the name or formula of an organic compound in terms of the functional groups present in the molecule, its stereochemistry including dynamic structure, and electronic properties. Explain and carry out the process of characterizing simple organic compounds using spectroscopic methods including NMR and IR spectroscopy.
3. Associate typical chemical reactivity with different functional groups and write equations for the reactions.
4. Be able to recognize and use some of the common mechanisms of organic reactions to explain and predict products. Write chemical equations for and analyse organic reactions in contents such as industrial processes and biological transformations.
5. Relate the concept of chemical equilibrium to reactions, including organic transformations, to analyse properties such as acidity and basicity; and apply the concept to industrial, biological and environmental processes.
6. Use the ideas of reaction kinetics to analyse reactions in terms of fundamental molecular processes and interpret the consequences for the preparation and reactions of organic materials.

Outline: This paper takes a wide range of examples from everyday life to illustrate concepts of organic and biological chemistry. The structure, properties and reactions of organic compounds, identification of organic compounds using spectroscopy, and the mechanisms of organic reactions are covered. It also introduces the concepts of chemical equilibrium, particularly as they are applied to acids and base, and chemical kinetics.

Pre-requisites: Students will be assumed to have studied at least 20 credits from NCEA Level 3 Chemistry and achieved at least 14, or passed Bursary Chemistry or 123.103 or an acceptable alternative.

Extramural: Available extramurally

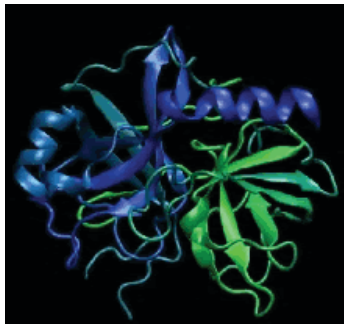
Assessment:

Laboratory Reports	20%
Mastery Tests	10%
Semester Test	20%
Final Examination	50%

Textbook: Chemistry Author: Blackman et al Publisher: Wiley, 2008

YEAR ONE - Semester 2

122.102 Biochemistry of Cells



Paper Co-ordinator: Assoc Professor Kathryn Stowell

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Understand and explain in writing the basic concepts of protein structure and how this relates to function, including the basic concepts of enzymology, such as mechanisms of catalysis and basic kinetic parameters.
2. Understand and explain in writing the basic concepts of carbohydrate structure and function, lipid structure and function, the structure and function of biological membranes and movement of molecules across membranes.
3. Demonstrate an understanding of how energy is obtained from food and utilized by living organisms, with reference to the pathways of glycolysis, the citric acid cycle, oxidative phosphorylation and gluconeogenesis, lipid and protein metabolism and basic concepts of metabolic regulation of these processes.
4. Demonstrate an understanding of the importance of ATP and proton gradients to living systems, including some aspects of muscle action and of photosynthesis.
5. Carry out some basic biochemical laboratory procedures and related biochemical calculations, including use of spectrophotometers, quantitative analysis of biological samples and measurement of enzyme activity.
6. Use a modern biochemistry textbook for reference or further learning.

Outline: A foundation course that introduces molecular aspects of the cellular processes occurring in humans, animals, microbes and plants. An exploration of the molecules of life, proteins and enzymes in action, energy for living and energy storage with applications to the environment, health and disease, biotechnology, nutrition, sport and exercise. Theoretical aspects are supported by a practical laboratory programme.

Pre-requisites: 123.101 (or 123.111) and 162.101.

Extramural: Not available extramurally

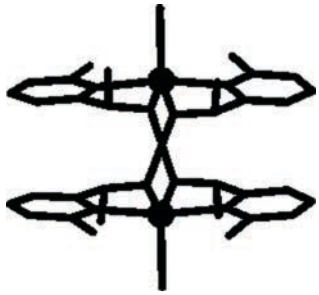
Assessment:

Semester test	15%
Mastery Biology Assignment	5%
Lab Assignment	5%
Lab Reports	5%
Lab Theory Test	10%
Final examination	60%

Textbook: No set textbook

YEAR ONE - Semester 2

123.102 **Chemistry and the Material World**



Paper Co-ordinator: Dr Mark Waterland

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Discuss how chemistry and its applications impact society, and describe modern experimental techniques for chemical analysis and structure determination.
2. Explain the fundamental principles of atomic structure and their relationship to the periodic table, and the nature of covalent bonding.
3. Explain the colour, magnetism and chemical properties including catalysis, of compounds containing transition metals in terms of the structures of transition metal complexes.
4. Analyse chemical reactions by calculating the amount of energy released and the extent of energy dispersal and demonstrate that spontaneous chemical reactions always occur with an increase in the total extent of energy dispersal.
5. Use the concepts of non-covalent interactions to explain the properties of matter including gases and liquids and phenomena such as self-assembly.
6. Calculate the electrochemical potential of cells using the IUPAC convention and the Nernst equation, predict spontaneity of chemical processes and apply the concepts to electrolytic processes.
7. Demonstrate proficiency with basic practical techniques in the chemistry laboratory, and be familiar with the structures and names of the elements, and simple complexes, cations and anions.

Outline: This paper begins with a discussion of the impact of chemistry and its applications on modern society. Within this context, students will learn of the central role of energy dispersal in chemical and electrochemical transformations. Atomic structure will be related to the properties of elements and fundamental bonding theories will be used to rationalise molecular structures. Transition metal chemistry will be used to illustrate these concepts. Students will learn of the importance of intermolecular forces in determining the properties of matter.

Pre-requisites: NCEA Level 3 Chemistry, studied 20 credits achieved 14 credits minimum, or Bursary Chemistry, or 123.103.

Extramural: Available extramurally

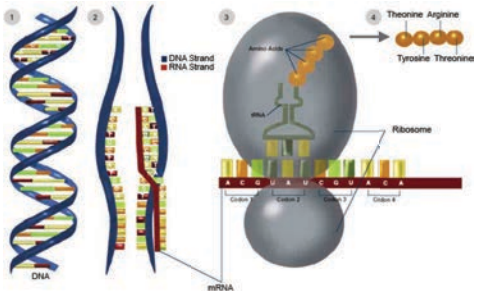
Assessment:

Mastery tests	10%
Semester test	20%
Laboratory test	10%
Laboratory work	10%
Final examination	50%

Textbook: Highly Recommended: Chemistry Author: Allan Blackman ISBN: 9 78047081 Edition: 1st Edition (2008) Publisher: John Wiley & Sons Australia

YEAR TWO - Semester 1

122.231 Genes and Gene Expression



Paper Co-ordinator: Assoc Prof Kathryn Stowell

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Demonstrate a detailed understanding of the main components of DNA structure at the molecular and macromolecular level.
2. Demonstrate a detailed understanding of the major molecular mechanisms involved in DNA replication, transcription and regulation of gene expression in E.coli.
3. Understand and explain the basic tools and techniques required to carry out in vitro manipulation of recombinant DNA and associated techniques, including the preparation and use of both genomic and cDNA libraries.
4. Design basic experimental strategies to construct recombinant plasmids.
5. Carry out basic experimental techniques central to the manipulation of recombinant DNA, eg: plasmid DNA preparation, restriction endonuclease digestion, agarose gel electrophoresis, bacterial transformation and the polymerase chain reaction.
6. Competently carry out numerical calculations required for general laboratory work required for biochemistry and molecular biology.

Outline: Structure of DNA. Replication, DNA repair and transcription. Regulation of prokaryote gene expression. Technologies used in the study of genes and gene expression: plasmids, sequencing, restriction enzymes, libraries, PCR, Southern, northern and western analysis, expression vectors and the production of recombinant proteins. A practical course that illustrates concepts presented in the lectures.

Pre-requisites: 162.101 Biology of Cells

Extramural: Not available extramurally.

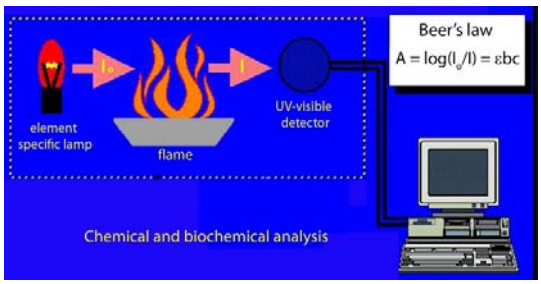
Assessment:

Laboratory exercises	2.5%
Laboratory Report	5%
Numeracy Test	2.5%
Lab Theory Test	20%
Semester test	10%
Final examination	60%

Textbook: Molecular Biology Author: Weaver Edition: 4th

YEAR TWO - Semester 1

123.204 Chemical and Biochemical Analysis



Paper Co-ordinator: Dr Paul Plieger

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Understand the fundamentals of gravimetric and titrimetric analysis.
2. Understand the fundamentals of spectroscopy.
3. Understand the ways in which spectroscopic techniques can be used in the identification and measurement of elements, and chemicals and biological compounds.
4. Understand the fundamentals of radiochemistry.
5. Understand the ways in which radiochemistry techniques can be used in the identification of elements.

Outline: A paper that introduces the underlying concepts and practical methodologies used for the analysis of chemical and biochemical compounds. Both qualitative and quantitative aspects of chemical and biochemical analyses using a range of spectroscopic and laboratory techniques will be studied.

Pre-requisites: 122.101 Chemistry and Living Systems or 123.102 Chemistry and the Material World. A good pass in 123.103, Introductory Chemistry, may be acceptable.

Extramural: Not available extramurally.

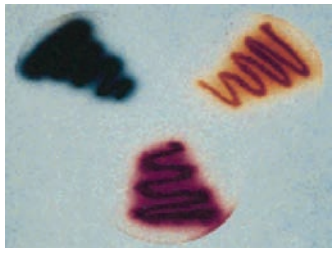
Assessment:

Assignment	10%
Laboratory Reports	20%
Laboratory Test	10%
Final Examination	60%

Textbook: Recommended:
Fundamentals of Analytical Chemistry - Author: Skoog, West, Holler and Crouch ISBN: 0-534-41793-3 (int'l student) Edition: Eighth Publisher: Brooks and Cole

YEAR TWO - Semester 1

162.211 Biology and Genetics of Microorganisms



Paper Co-ordinator: Dr Jan Schmid

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Be familiar with fundamental aspects of the biology of the major groups of microorganisms, including their structure, physiology, metabolism and genetics.
2. Recognise the importance of microbes in human affairs, that they are essential parts of all local and global ecosystems, and indispensable for sustaining life on earth.
3. Recognise the importance of microbes for all disciplines of biological research.
4. Be able to apply theoretical knowledge on how microbes function and technical skills taught to successfully carry out basic manipulations of microorganisms as required within biological sciences and related disciplines.
5. Describe key immunological techniques.
6. Describe career paths open to microbiology graduates.

Outline: Structure and metabolism of bacteria and their relationship to the environment. Bacterial genetics. Eukaryotic microbes – structure, physiology and genetics. Life cycle of viruses. The immune response. Practical training in the manipulation of microorganisms.

Pre-requisites: 162.101

Extramural: Not available extramurally.

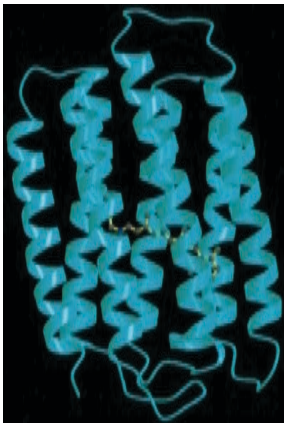
Assessment:

Semester Test	19%
Lab Exercise Assessment	18%
Career Exercise	2%
Final Examination	61%

Textbook: Biology of Microorganisms - Author: Madigan, M.T., Martinko, J.M, Dunlap, P.V. & Clark, D.P Edition: 13th Publisher: Prentice-Hall (Notes: Earlier editions are adequate for most of the material covered)

YEAR TWO - Semester 2

122.232 Protein Biochemistry



Paper Co-ordinator: Dr Gill Norris

Learning Outcomes: Students who successfully complete this paper will be able to:

1. How proteins are synthesized in the cell then transported to their different destinations in the cell to carry out their various roles and the role of post-translational modifications in targeting and tuning function.
2. Basic enzyme kinetics.
3. The relationship of protein functions to both primary and tertiary structure.
4. The properties of and models for the organization of cell and organelle membranes and the proteins within those membranes. The effect of detergents on membrane components; the transport of molecules through membranes.
5. The structure and function of some membrane proteins, including ion channels and receptors.
6. The techniques required to carry out basic biochemical experiments. How to interpret experimental data and write up the results in report format.

Outline: How proteins are synthesised in the cell and directed to carry out their various roles. Topics will include protein biogenesis, targeting and post-translational modification, the relationship between protein structure and function, catalytic proteins, structural proteins, membranes and membrane proteins. Lectures will be complemented with a practical course focused on developing skills to investigate proteins

Pre-requisites: 122.102 Biochemistry of Cells

Extramural: Not available extramurally.

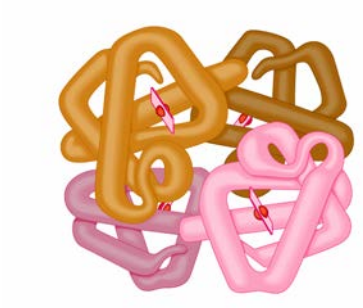
Assessment:

Practical work	5%
Reports	15%
Mid Semester Test	20%
Final Examination	60%

Textbook: Biochemistry Author: D. Voet and J.G. Voet ISBN: 0471250899 (v. 2) 0471250 Edition: 3rd Edition Publisher: New York ; Chichester : Wiley, 2003

YEAR TWO - Semester 2

122.233 Metabolic Biochemistry



Paper Co-ordinator: Dr Jeong Park

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Have a basic understanding of the dynamic aspects of cellular processes and of the integration of bio-chemical processes within cells (including an understanding of cellular communication and metabolism).
2. Be adequately prepared to undertake an advanced course in practical biochemistry.

Outline: Energy metabolism. Biosynthesis of carbohydrates and the metabolism of polysaccharides. Lipid metabolism. Nitrogen metabolism. Integration and regulation of carbohydrate, lipid and amino acid metabolism. Cellular communication systems.

Pre-requisites: 122.102 Biochemistry of Cells

Extramural: Not available extramurally.

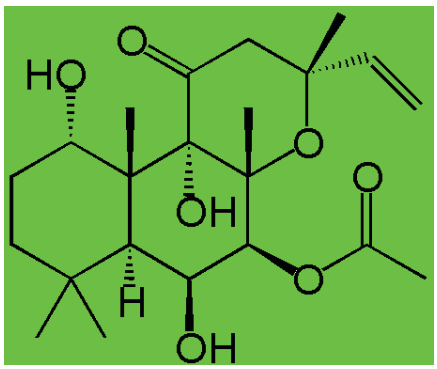
Assessment:

Laboratory reports/assignments	20%
Semester Test	20%
Final Examination	60%

Textbook: Textbook of Biochemistry with Clinical Correlations Author: Devlin ISBN: 9780470281734 Edition: 7th Publisher: John Wiley & Sons

YEAR TWO - Semester 2

123.202 Organic and Biological Chemistry



Paper Co-ordinator: Dr Gareth Rowlands

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Develop a knowledge and understanding or organic chemistry and be able to apply what they have learnt to predicting the reactions of new compounds.
2. Understand how biological molecules interact in vivo.
3. Rationalise the stereochemical outcome of reactions.
4. Interpret NMR and mass spectra.
5. Carry out organic synthesis.

Outline: Students will find out how to apply simple principles to understand the reactions of organic and biological molecules. This will provide the knowledge needed to predict how organic reactions work and to understand the related biological processes. Students will also be given the tools to identify a variety of different molecules. The laboratory course will cover the making and identification of organic materials, using the principles that have been learned in the lecture course.

Pre-requisites: 123.101 Chemistry and Living Systems or 123.171 Chemistry for Biological Systems 1

Extramural: Not available extramurally.

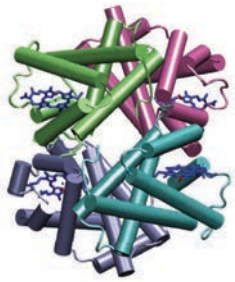
Assessment:

Laboratory Reports	20%
Semester Test	20%
Final Examination	60%

Textbook: No set textbook

YEAR THREE – Semester 1

122.322 Protein Structure and Function



Paper Co-ordinator: Dr Andrew Sutherland-Smith

Learning Outcomes: Students who successfully complete this paper will be able to:

1. The main components of protein structure at the molecular level.
2. The principles of protein folding and the experimental techniques used to follow folding processes.
3. The principles of protein purification, proteomic and biochemical methods of protein characterization and methods of protein structure determination. The student should be able to apply this knowledge to explain novel observations and data obtained by experiment in the laboratory as well as solve new problems.
4. How chemical concepts and the evolution of enzyme activity central to understanding enzyme reaction mechanisms.
5. The principles of molecular recognition by proteins and application of these principles to new examples and problems.
6. Carry out experimental techniques central to the manipulation of proteins, e.g. protein purification, gel electrophoresis, immunoblotting, enzyme assays, liquid chromatography, UV visible spectroscopy and structural analysis by computer graphics.

Outline: The structural and biochemical basis of protein function will be explored with an emphasis on techniques of protein isolation and purification, current methods of protein analysis, enzyme function and evolution, protein folding and molecular interactions. A laboratory and computer-based practical course in protein purification and analysis reinforces the theoretical aspects of the paper.

Pre-requisites: 122.232 Protein Biochemistry

Extramural: Not available extramurally

Assessment:

Laboratory reports	20%
Assignments	10%
Semester Test	20%
Final Examination	50%

Textbook: Biochemistry - Author: Voet D. & Voet J.G. ISBN: 978-0-470-57095-1 Edition: 4th Publisher: John Wiley & Sons

YEAR THREE – Semester 1

203.300 DNA Technology

Paper Co-ordinator: Dr Jasna Rakonjac

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Describe the biology that underlies DNA technology.
2. Describe the ways in which this underlying biology is manipulated in DNA technology.
3. Identify and describe the questions that can be addressed using DNA technology.
4. Demonstrate use of advanced skills in experimental molecular biology and DNA technology and explain the theoretical basis of these techniques.
5. Critically analyze, accurately observe and interpret experimental data from laboratory work and from the scientific literature.

Outline: DNA structure, topology and recombination. The contributions of bacteriophage to DNA technology. Advanced applications of gene cloning, PCR, microarrays and gene targeting. Practical experience will be gained with DNA quantification, molecular cloning, PCR, DNA sequencing, computer analysis and expression of heterologous genes.

Pre-requisites: 122.231 Genes and Gene expression

Extramural: Not available extramurally

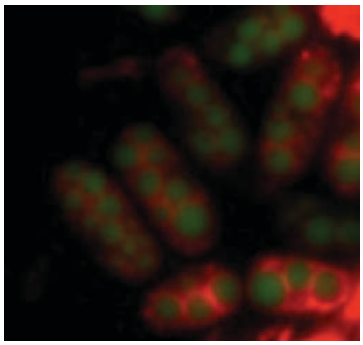
Assessment:

Laboratory notebook	5%
Assignment	10%
Laboratory test	15%
Semester Test	10%
Final Examination	60%

Textbook: Molecular Biology _ Author: Weaver, R.F. ISBN: 0071316868 5th edition Publisher: McGraw-Hill

YEAR THREE – Semester 1

203.307 Advanced Cell Biology



Paper Co-ordinator: Dr Tracy Hale

Learning Outcome: Students who successfully complete this paper will be able to:

1. Have acquired advanced skills in experimental cell biology and understand the theoretical basis of these techniques.
2. Describe the function and biogenesis of organelles.
3. Describe the organisation of the nucleus.
4. Describe how the cell cycle is controlled.
5. Describe the assembly, organisation and roles of the cytoskeleton.
6. Describe the roles of signal transduction pathways in relaying signals from the extracellular environment to the nucleus and their contribution to cancer.
7. Describe how cell lineages arise and are regulated.

Outline: A paper with a strong emphasis on the structure and function of cell components and the interactions between cells. Topics covered include chromosome structure and function, cell cycle, signal transduction, cytoskeleton and molecular motors, extracellular matrix, cell motility stem cells, cell death and cancer. The practical component has a strong emphasis on biochemical, genetic and microscopic methods that are used to study cells..

Pre-requisites: 162.101 Biology of Cells,
122.231 Genes and Gene Expression.

Extramural: Not available extramurally.

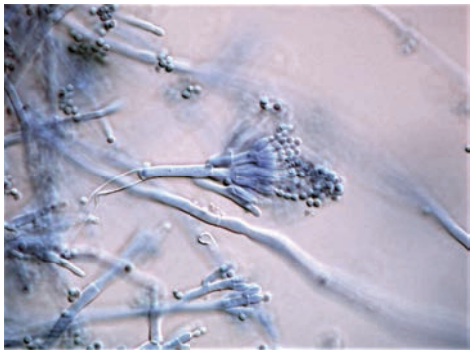
Assessment:

Chromosome lab test	10%
Reports (3)	15%
Semester Test	20%
Final Examination	55%

Textbook: Molecular Cell Biology Author: Lodish et al. Edition: 6th edition Publisher: WH Freeman and Co.
Molecular Biology of the Cell Author: Alberts et al. Edition: 5th, 2007 Publisher: Garland Publications

YEAR THREE – Semester 1

123.312 Advanced Organic Chemistry



Paper Co-ordinator: Dr Vyacheslav Filichev

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Plan the synthesis of a target molecule.
2. Propose mechanisms and explain the outcomes of reactions discussed in terms of product distributions and stereochemistry.
3. Assign the NMR spectrum of a molecule and propose a structure for an unknown molecule on the basis of NMR spectra.
4. Perform laboratory syntheses of molecules according to literature processes.

Outline: Structure, reactivity and synthesis of organic molecules, retrosynthetic analysis, reactive intermediates, stereoelectronic effects, heterocyclic chemistry and nuclear magnetic resonance spectroscopy (NMR) including 2D and multinuclear experiments. The emphasis is on understanding organic reactions, utilizing them to make molecules of interest, and structural characterization by NMR. Lectures are complemented by problem solving sessions and a laboratory course which includes a small project.

Pre-requisites: 123.202 Organic and Biological Chemistry and 123.204 Chemical and Biochemical Analysis

Extramural: Not available extramurally

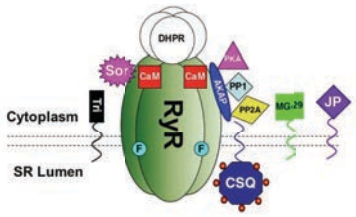
Assessment:

Laboratory reports	25%
Mid Semester Test	20%
Final Examination	55%

Textbook: No set textbook

YEAR THREE – Semester 2

122.327 Advanced Biochemistry



Paper Co-ordinator: Assoc Prof Kathryn Stowell

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Understand and build on their learning of the mechanisms of transport across biological membranes.
2. Discuss the structure and function of the proteosome, its role in protein turnover and regulation of protein stability.
3. Discuss the molecular mechanisms associated with the regulation, at the gene level, of selected metabolic pathways by specific nutrients.
4. Carry out a selection of contemporary biochemistry techniques frequently used in the research environment including critical analysis of results.
5. Critically examine and interpret selected areas of the primary literature.
6. Demonstrate a sound knowledge and understanding of calcium signalling and homeostasis in muscle and molecular immunology.

Outline: Selected cellular processes and systems will be explored at the molecular level. These include nutrient control of metabolism, protein turnover, signalling systems in health and disease, molecular immunology, molecular transport systems and advanced plant biochemistry. A laboratory course in contemporary biochemical techniques aimed at preparation for postgraduate research in cellular and molecular biochemistry.

Pre-requisites: 122.233 Metabolic Biochemistry, 122.232 Protein Biochemistry

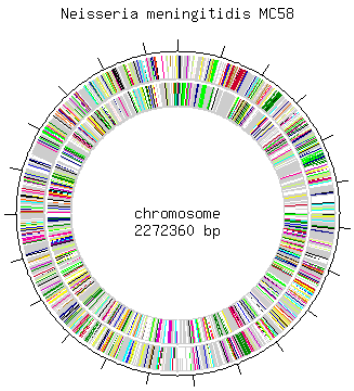
Extramural: Not available extramurally

Assessment:

Laboratory Reports	20%
Assignment	10%
Semester Test	10%
Final Examination	60%

Textbook: No set textbook

YEAR THREE – Semester 2



122.328 Genome Analysis

Paper Co-ordinator: Dr Claudia Voelckel

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Explain the strategies involved in whole genome sequencing, gene annotation and data analysis.
2. Use appropriate bioinformatic tools to search and interpret DNA and protein sequence databases to identify sequences relevant to biological functions.
3. Design strategies to investigate genotype and phenotype based on whole genome analyses.
4. Interrogate protein structure databases and interpret the data in terms of the relationships between primary sequence and tertiary structure and function.
5. Interpret nucleotide and protein sequence data to determine evolutionary relationships between organisms.
6. Explain the principles of transcriptomic, proteomic, metabolomic, epigenomic and metagenomic analyses and their relationship to systems biology.

Outline: An interactive and self-directed learning approach will be used to explore the analysis of genomes, transcriptomes, proteomes and metabolomes. The emphasis will be on understanding and applying a range of methodologies involved in extracting biologically significant information from both existing and novel data sets.

Pre-requisites: 203.300 DNA Technology

Extramural: Not available extramurally.

Assessment:

Weekly computer exercises	40%
Assignment (whole genome analysis)	20%
Assignment (functional genomics)	20%
Assignment (elective)	20%

Textbook: No set textbook

YEAR THREE – Semester 2

203.303 Gene Regulation

Paper Co-ordinator: Assoc Professor Kathryn Stowell

Objective:

Students who successfully complete this paper will be able to:

1. Demonstrate an understanding of the experimental approaches used to identify the DNA sequences that control gene expression and the proteins that interact with these sequences.
2. Demonstrate an understanding of the transcription apparatus in eukaryotes and a global switch in gene expression in prokaryotes.
3. Describe and critically discuss the role of chromatin structure in gene regulation.
4. Explain the molecular mechanisms of RNA splicing and the regulation of splicing as a means of altering gene expression, with an emphasis on discussion of the experimental work used to develop the associated models.
5. Demonstrate an understanding, in the context of experimental evidence, of the regulation of globin gene/gene expression in mammals, sex determination in Drosophila and iron homeostasis in mammals.
6. Demonstrate an understanding of the biogenesis, in vivo and in vitro uses of siRNA and miRNA.

Outline: An advanced course on gene regulation. Topics include methods and experimental strategies for studying gene promoters and associated transcription factors, transcription initiation, transcription activation, role of chromatin structure in gene regulation, RNA processing and cytoplasmic control.

Pre-requisites: 203.300 DNA Technology

Extramural: Not available extramurally.

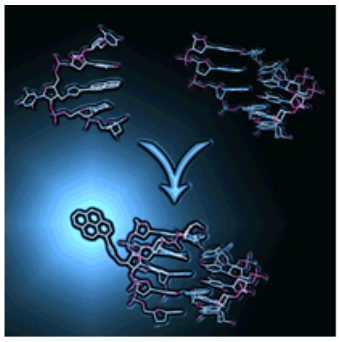
Assessment:

Problem sheets (2)	10% each
Oral presentation	10%
Semester Test	10%
Final Examination	60%

Textbook: Molecular Biology. Weaver. 4th edition, McGraw-Hill, New York

YEAR THREE – Semester 2

123.326 Advanced Chemical Biology



Paper Co-ordinator: Dr Vyacheslav Filichev

Objective:

Students who successfully complete this paper will be able to:

1. The student through lectures and a computer-based lab will develop a sound understanding of protein and DNA/RNA architecture and of how architecture controls function.
2. The student will understand the organic reaction mechanisms of hydrogel gel formation and of selected key classes of ribozymes; this understanding will be complemented by laboratory experiments.
3. The student will learn of modern applications of mass spectrometry to Chemical Biology.
4. The student will understand that both enthalpic and entropic factors (respectively the thermo and dynamics of thermodynamics) are key to macromolecular function through study of metal trafficking and bio-nanomachines.
5. The student will gain understanding into how components are assembled for complex processes, including drug-protein and drug-RNA/DNA delivery.

Outline: The fundamental molecules of life with an examination of the chemical basis for their biological functions. The fundamentals of chemical and biological catalysis will be explored, and the actions of drug molecules as mimics or inhibitors of bioprocesses will be discussed. Physical aspects and energetics will be addressed. A laboratory programme and written and oral assignments will complement the lecture material.

Pre-requisites: 123.202 Organic and Biological Chemistry

Extramural: Not available extramurally

Assessment:

Laboratory	10%
Oral presentation	15%
Mid Semester Test	15%
Final Examination	60%

Textbook: No set textbook

YEAR THREE – Semester 1, 2 and Summer School

247.300 Research in Biosciences

Paper Co-ordinator: Dr Vaughan Symonds

Learning Outcomes: Students who successfully complete this paper will be able to:

1. Gain practical research experience in biological sciences.
2. Understand how to plan and implement a research project.
3. Become familiar with data interpretation, analysis and presentation.
4. Become a self-sufficient laboratory worker.
5. Become familiar with a wide range of biological science techniques, projects, and literature.

Outline: The paper provides an opportunity for third year undergraduate students in the biological sciences to gain research experience in an academic laboratory. Under supervision of faculty students will develop a short research proposal, carry out the proposed research, write a research report, and present their findings.

Pre-requisites: Permission of Programme Director (A- average required for this paper)

Extramural: Not Available extramurally.

Assessment:

Mini-research proposal	20%
Research activities	20%
Oral report	10%
Research Report	50%

Textbook: No set textbook

BSc Biochemistry

YEAR ONE

S1: 123.101
Chemistry & Living Systems

S1: 162.101
Biology of Cells

S1: 119.155
Communications in Sciences

S2: 122.102
Biochemistry of Cells

S2: 161.130
Biometrics

Examples of elective papers in Sem 1 and 2:

S1: 199.101
Biology of Animals

S2: 123.102
Chemistry & the Material World

S2: 120.101
Biology of Plants

S2: 194.101
Essentials of Mammalian Biology

YEAR TWO

S1: 122.231
Genes and Gene Expression

S2: 122.232
Protein Biochemistry

S2: 122.233
Metabolic Biochemistry

Examples of elective papers in Sem 1 and 2:

S2: 162.211
Biology and Genetics of Microorganisms

S1: 123.204
Chemical and Biochem Analysis

S1: 194.241
Physiological Control Systems

S1: 203.203
Human Genetics

S2: 123.202
Organic and Biological Chemistry

S2: 151.232
Nutrition & Metabolism

S2: 196.207
Biological Evolution

YEAR THREE

S1: 122.322
Protein Structure and Function

S1: 203.300
DNA Technology

S1: 203.307
Advanced Cell Biology

S2: 122.327
Advanced Biochemistry

S2: 203.303
Gene Regulation

Examples of elective papers in Sem 1 and 2:

S1: 123.312
Advanced Organic Chemistry

S2: 123.326
Advanced Chemical Biology

S2: 162.312
Molecular Microbiology

S2: 194.346
Control of Metabolism

S2: 122.328
Genome Analysis

S1,S2 or S3: 247.300
Research in Biosciences

For a complete list of approved papers for all years, see p32,

For a complete list of approved papers for all years, see p32,

Research

The Institute of Molecular BioSciences at Massey University in Palmerston North has active research programmes carried out by staff and postgraduate students. Here we list only the main areas of interest of academic staff. Students should be aware that summer studentships are available and will be advertised in October/November each year. Check on the Massey website: http://imbs.massey.ac.nz/Teaching/Summer_Fellowships.htm

Research Interests of Academic Staff in Biochemistry and Related Disciplines

Kathryn Stowell	Biochemistry, genetics and pathophysiology of human disorders
Mark Patchett	Molecular enzymology
Gill Norris	Protein structure, x-ray crystallography, glycobiology
Andrew Sutherland-Smith	Structural and functional studies on proteins implicated in human diseases
Jasna Rakonjac	Molecular biology of bacteriophage/bacteria; phage display
Barry Scott	Gene regulation and expression in plant-microbe interactions
Rosie Bradshaw	Fungal molecular genetics
Evelyn Sattlegger*	Stress, nutrient starvation and mechanisms of signal transduction
Jeong Park	Mammalian Biochemistry
Tracy Hale	Cell Biology

***** Albany Campus

General Information

Student Services

Student Services at Massey University Manawatu provide support to particularly first-year students to successfully integrate into university life and academic study. Check the website to find more out about their role: http://students.massey.ac.nz/

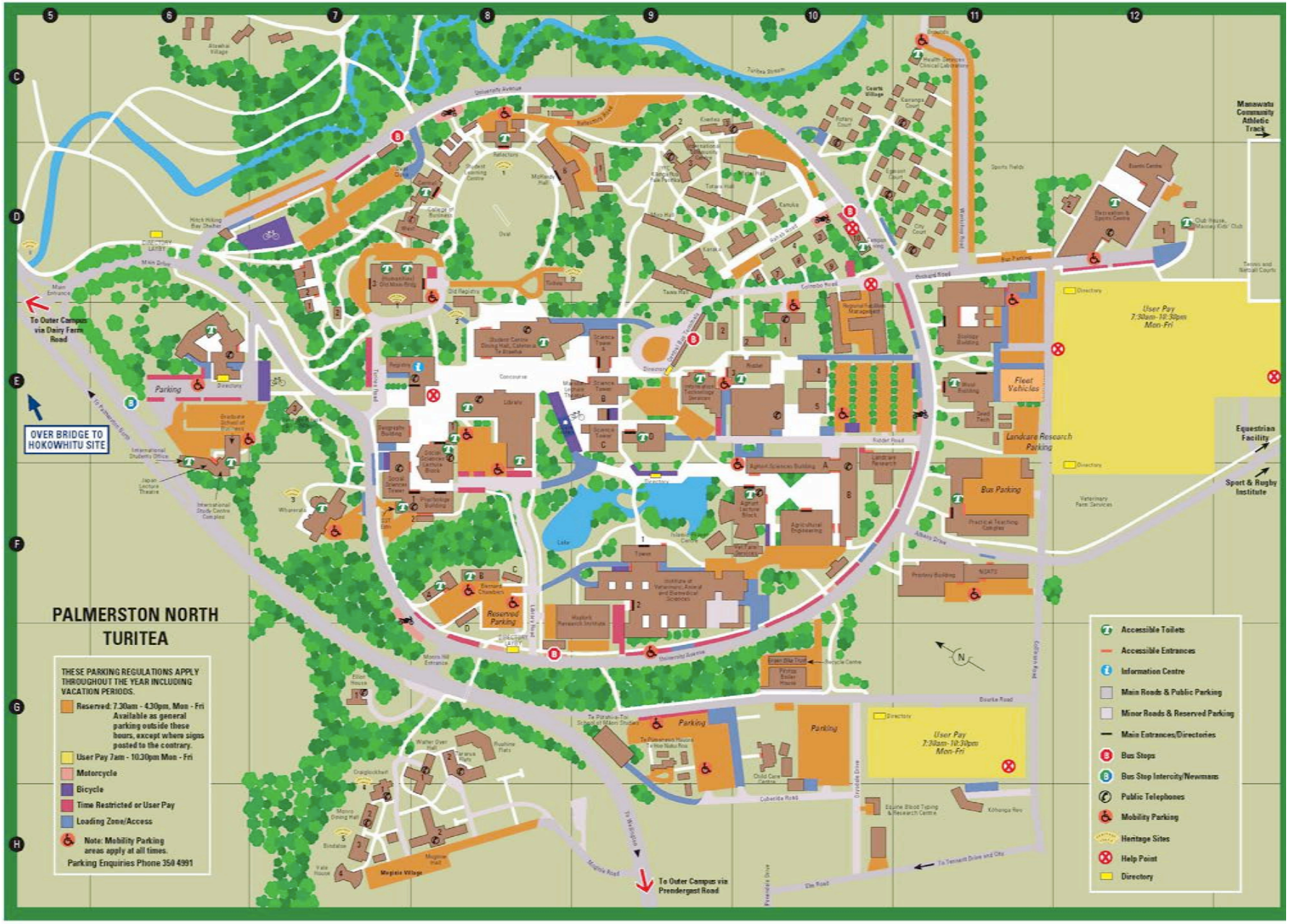
Student Learning Centre

The Student learning Centre offers a whole range of support classes for undergraduate, postgraduate, internal, extramural or international students. For details, please see: http://learning.massey.ac.nz/. Students with poor English language skills are advised to include 192.102 (Academic writing for speakers of other languages) in to their degree programme.

Extramural Study

At present it is not possible for students to complete an extramural BSc with a major in Biological Sciences. However, some papers of relevance to Biological Sciences students are offered from time to time. For details, check the 'Enrolment Science 2009' Handbook.

Notes


PALMERSTON NORTH
TURITEA
THESE PARKING REGULATIONS APPLY THROUGHOUT THE YEAR INCLUDING VACATION PERIODS.
Reserved: 7.30am - 4.30pm, Mon - Fri
Available as general parking outside these hours, except where signs posted to the contrary.
User Pay 7am - 10.30pm Mon - Fri
Motorcycle
Bicycle
Time Restricted or User Pay
Loading Zone/Access
Note: Mobility Parking areas apply at all times.
Parking Enquiries Phone 350 4991
OVER BRIDGE TO HOKOWHITU SITE
To Outer Campus via Dairy Farm Road
To Outer Campus via Prendergast Road
Accessible Toilets
Accessible Entrances
Information Centre
Main Roads & Public Parking
Minor Roads & Reserved Parking
Main Entrances/Directories
Bus Stops
Bus Stop Intercity/Newmans
Public Telephones
Mobility Parking
Heritage Sites
Help Point
Directory
User Pay 7:30am-10:30pm Mon-Fri
Fleet Vehicles
Landcare Research Parking
Bus Parking
Equestrian Facility
Sport & Rugby Institute
Manawatu Community Athletic Track
Reserved Parking
Parking

To find information about the BSc programme, majoring requirements for Biochemistry and papers offered, the following information is provided on the Massey University website:

MASSEY UNIVERSITY
COLLEGE OF SCIENCES
TE WĀHANGA PŪTAIAO

Bachelor of Science (BSc)

Bachelor of Science (Biochemistry)

Entry Requirements

All students must have a university entrance qualification. Students beginning their study of Biochemistry should have a sound background in Chemistry and Biology at NCEA Level 3.

However, if you do not have a background of chemistry at the Year 13 level then you can take 123.103 Introductory Chemistry extramurally through Massey University over the summer before your first year of full-time study. This paper will introduce you to basic chemical vocabulary and provides training in the important chemical principles. You do need to already have a university entrance qualification or to expect to obtain one by sitting NCEA Level 3 at the end of this year. If you are interested in this suggestion get in touch with one of the College of Sciences contact people. Similarly, if you have not done NCEA Level 3 Biology you can take 162.103 Introductory Biology over the summer.

In Semester One of their first year students intending to major in Biochemistry should take 123.101 and 162.101 as these are both majoring requirements. In addition, Biochemistry students are strongly recommended to take 123.102 Chemistry and the Material World in their second semester and also take papers in other biological sciences.

For general entry requirements see Massey University entry requirements.

Bachelor of Science (Biochemistry) Structure

Biochemistry is the study of the molecular basis (or chemistry) of life. Biochemistry is based on chemistry and concerns the chemical components, chemical reactions and physiological processes that occur in living systems and which are essential for life. Although it overlaps other disciplines, including cell biology, genetics, immunology, microbiology, pharmacology and physiology, Biochemistry focuses on the following issues: the chemical and three-dimensional structures of biological molecules; how these biological molecules interact with one another; how the cell synthesizes and degrades biological molecules; how energy is conserved and used by the cell; how biological molecules are organised and their activities are coordinated; how genetic information is stored, transmitted and expressed. Biochemistry is a discipline that appeals to people who like to look into how things happen.

Majoring Requirements

123.101 Chemistry and Living Systems,
122.102 Biochemistry of Cells,
162.101 Biology of Cells,

122.231 Genes and Gene Expression,
122.232 Protein Biochemistry,
122.233 Metabolic Biochemistry,
122.322 Protein Structure and Function,
203.300 DNA Technology,
203.303 Gene Regulation,

plus two of
162.211 Biology and Genetics of Microorganisms,
122.327 Advanced Biochemistry,
203.307 Advanced Cell Biology.

Biochemistry majors are strongly advised to take either 162.211 Biology and Genetics of Microorganisms and/or 123.204 Chemical and Biochemical Analysis.

Papers

Manawatu

122.102 Biochemistry of Cells
123.101 Chemistry and Living Systems
123.102 Chemistry and the Material World
123.103 Introductory Chemistry
162.101 Biology of Cells
122.231 Genes and Gene Expression
122.232 Protein Biochemistry
122.233 Metabolic Biochemistry
123.202 Organic and Biological Chemistry
123.204 Chemical and Biochemical Anaylsis
162.211 Biology and Genetics of Microorganisms
123.326 Advanced Chemical Biology
122.322 Protein Structure and Function
122.327 Advanced Biochemistry
122.328 Genome Analysis
162.312 Molecular Microbiology
194.346 Control of Metabolism
203.300 DNA Technology
203.303 Gene Regulation
203.307 Advanced Cell Biology
247.300 Research in Biosciences