Bachelor of Food Science

First-year subjects

202-101 Chemistry for Land and Food Resources
See full subject details on page 1.

610-141 Chemistry A
See full subject details on page 2.

202-103 Biology for Land and Food Resources
See full subject details on page 1.

650-141 Biology of Cells and Organisms
See full subject details on page 1.

202-104 Information Technology and Communication
See full subject details on page 1.

202-107 Mathematics for Land and Food Resources
See full subject details on page 1.

208-101 Farm Animal Biology
See full subject details on page 5.

208-109 Australian Agriculture
See full subject details on page 1.

650-142 Genetics & The Evolution of Life
See full subject details on page 1.

207-101 Land, Food and Resource Economics
See full subject details on page 2.

208-106 Introduction to Food Science
Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Said Ajlouni

Prerequisites: 202-101 Chemistry for Land and Food Resources or 610-141 Chemistry.

Contact: Thirty-six hours of lectures and 24 hours of tutorials and field site visits *(Semester 2).*

Description: Introduction to Food Science provides an overview of the course, introducing students to the make-up and structure of food and its importance in nutrition, health and well-being. Because food processing relies on an understanding of engineering principles, this subject will also provide a brief overview of the physical properties that influence changes in foods during handling, formulation, and processing. The content will include an overview of food components, additives and preservatives and their importance in nutrition, food safety and product quality; physical properties of foods; physics and engineering principles underlying processes used in the food.

On completion of this subject, students should be able to:

- recognise the chemical, physical and nutritional properties of major and minor food components;
- recognise the major food components in terms of chemical structure, reactivity and physical properties;
- describe the nature of foods and their interaction with food additives (coloring, flavoring, and functional ingredients);
- explain and apply the basic principles underlying the processes used in food preservation and processing; and
- understand the nature of unit operations used in the food industry.

Assessment: Assignment of 1500 words (20%) and two 2-hour examinations (40% each).

Prescribed texts: S P Murano, *Understanding Food Science and Technology*, Thomson Learning Academic Resource Centre, Wadsworth, USA, 2003.

202-106 Land Resources
See full subject details on page 2.

208-107 Vineyard and Winery Operations I
See full subject details on page 5.

610-142 Chemistry B
See full subject details on page 2.

Second-year subjects

526-201 Principles of Microbiology & Immunology
See full subject details on page 1.

202-202 Experimental Design/Statistical Methods
See full subject details on page 2.

208-225 Food Chemistry, Biology and Nutrition
Availability: Lectures at Parkville campus; practicals at Gilbert Chandler campus

Credit points: 12.5

Coordinator: Dr Hubert Roginski

Prerequisites: 202-101 Chemistry for Land and Food Resources or 610-141 Chemistry.

Contact: Thirty-six hours of lectures, 12 hours of tutorials and 24 hours of practicals and demonstrations (Semester 1) *(Semester 1).*

Description: Food is composed of natural materials of plant and animal origin plus additives that include flavours, colours, flavour-accentuating agents, micronutrients (vitamins, amino acids, minerals and trace elements) and preservatives. Microbes, or parts of these, may also be present due to their role in product preservation and flavour development of the final product. Building on the overview of these components in subject 208-106 Introduction to Food Science, the aim of this subject is to provide students with an understanding of the chemical structure of these components and the underlying biochemistry that is responsible for their synthesis. The fate of these components in terms of their biological (enzymatic) and chemical degradation when consumed will also be explored in context of their role in nutrition and cell biology. Practical exercises will provide an understanding of the methods commonly used in the food industry to analyse these components.

On completion of this subject students should be able to:

- describe the structure of the macro- and micro-components that make up food;
- describe the biochemical or chemical origin of these components;
- understand the fate of these components and their role in nutrition; and
- understand the basis of analysis of the major components of food, including carbohydrates, proteins, lipids, micronutrients, ingredients and additives.

Assessment: Two 2-hour examinations (one mid-semester), 40% each of final marks, and practical reports, 20% of final marks.

208-202 Animal Physiology
See full subject details on page 6.

208-206 Vineyard and Winery Operations II
See full subject details on page 6.

521-211 Biochemistry & Molecular Biology Part A
See full subject details on page 1.

208-216 Food Microbiology
Availability: Lectures at Parkville campus; practicals at Gilbert Chandler campus

Credit points: 12.5

Coordinator: Ms Susan Pepper

Prerequisites: 526-201 Principles of Microbiology and Immunology

Contact: 36 hours of lectures and 36 hours practical, demonstrations and computer-assisted learning (2nd semester, year 2) *(Semester 2).*

Description: Microbes (viruses, bacteria, fungi, parasites and other agents) can be associated with food in several ways: as components of the fermentation processes that are associated with the development of flavours and textures of food and its preservation; as the normal microflora that is associated with the origins of the food and persist during storage, possibly contributing to food spoilage; and as contaminants that enter food during processing or through subsequent mishandling, often posing public health risks. The aim of this subject is to familiarise students with: the microbes that are important in each one of these situations, including the major food pathogens and how to identify and characterise these through microbiological and genetic analysis: understanding the kinetics of bacterial growth and the factors that may alter this (altered water activity, low pH, temperature, preservatives) and the principles of modelling growth; principles of hazard and risk assessment in micro-

biological safety; the role of microbes in food processing, including examples of specific fermentation processes and waste treatment. Practical exercises and case studies will be undertaken to familiarise students with traditional and emerging microbiological techniques for detecting and identifying food microbes. Case studies will be performed in groups to develop investigative and group dynamic skills.

On completion of this subject, students should be able to:

- Describe the role that microbes may play in food production, preservation, storage and safety;
- Explain the principles of hazard analysis and critical control point assessment as applied to microbiological safety of food;
- Apply models of bacterial growth to predict the impact of storage conditions and the presence of growth inhibitors;
- Understand the role of microbes in product development, preservation and trait development;
- Analyse the microbiology of foods using standard microbiological techniques and apply new technologies for this purpose;
- Work within groups analysing and solving complex problems.

Assessment: Practical reports (20%); reports from case studies (20%), one 1-hour examination (mid-semester) (20%) and one 2-hour examination (40%).

208-226 Food Structure and Function

Availability: Lectures at Parkville campus; practicals at Gilbert Chandler campus

Credit points: 12.5

Coordinator: Prof Alan Hillier

Prerequisites: 208-225 Food Chemistry, Biology and Nutrition.

Contact: Thirty-six hours of lectures and 36 hours of practicals, demonstrations and computer-assisted learning *(Semester 2).*

Description: The basic biochemical components that form the structure of food products consist of the natural materials assembled in relationships that can be altered by the presence of additives, ingredients and processing or handling. This subject examines the macro structure of food, and the relationships between the basic structure and the additives (emulsifiers, flavours and other components in the environment of the total matrix), plus the physical chemistry of the components as part of a food matrix, including the influence of processing on these structures. This will include the interactions between emulsifiers and flavours within a food matrix, and interactions between water-proteins, water, lipids, protein-proteins, protein-lipids, protein-carbohydrates, and carbohydrate-lipids. This subject will describe the influence of processing on these interactions among food components.

On completion of this subject, students should be able to:

- recognise the importance of interactions of ingredients in food systems;
- describe the interaction of water with food components;
- explain the interactions of emulsifiers with other food components;
- describe the significance of flavour interactions with food matrix and their effects on perception;
- describe the role of interactions among food components on microstructure, texture and rheology of food products; and
- display an understanding of the impact of food processing on the interactions between macro-components of food components, the structure of the macro-components and the consequences of these interactions.

Assessment: One 2-hour examination, 40% of final marks, one open-book examination (mid-semester), 30% of final marks and one assignment of 3000 words, 30% of final marks.

Prescribed texts: G G Anilkumar (ed.), *Ingredient Interactions (Effect on Food Quality)*, Marcel Dekker, Inc., 1995.

207-201 Resource Management Economics

See full subject details on page 2.

208-201 Comparative Nutrition

See full subject details on page 5.

208-207 Animal Management and Production

See full subject details on page 7.

208-210 Agricultural Management Economics

See full subject details on page 3.

208-218 Production Management

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Mani Iyer

Contact: Five hours per week *(Semester 2).*

Description: The objective of this subject is to enable students to:

- state and evaluate the requirements of various regulations influencing food manufacturing units;
- identify strategies for scheduling of production;
- evaluate critical factors in planning and constructing a dairy food manufacturing unit, and apply an understanding of these factors to the design of a dairy food manufacturing unit;
- identify key components of an effective storage and distribution system for food;
- prepare operating budgets for defined production units;
- develop and implement strategies for the optimisation of production systems and resources;
- identify and evaluate different methods for treating factory effluent;
- implement strategies for preventative maintenance programs in a food production unit;
- understand the principles of factory layout, provision of factory services preventative maintenance, effective cleaning and sanitation practices, retrieval and storage of raw materials, prevention of contamination, effective personal hygiene practices, regulatory requirements and disposal of waste materials;
- understand the factors involved in factory layout and the associated provision of services;
- implement sound principles of raw material handling and storage;
- apply the principles of preventative maintenance;
- identify and manage sources of contamination of foodstuffs;
- have a working knowledge of regulations relevant to factory practice;
- understand factors affecting efficient cleaning and sanitation; and
- apply principles of waste disposal.

The content includes regulations and codes of practice; factory design, planning and construction; production scheduling; production scheduling; concepts, factors influencing production budgeting, factors influencing budget preparation, loss monitoring; stock rotation and control, storage, warehousing, materials handling, transport, regulatory requirements; effective storage and distribution systems, food storage requirements and systems; environment and effluent control, effluent disposal, types of effluent, regulations, costs; factory layout and services; raw material handling; preventative maintenance; contamination of foodstuffs; regulatory requirements; cleaning and sanitation; and waste disposal.

Assessment: Industry visit reports (3-5) of 1000 words (30% of final marks). Assignment - Literature Review of 2000 words (20% of final marks). One 2-hour examination (50% of final marks).

208-227 Molecular Biology of Food Microorganisms

Availability: Gilbert Chandler campus

Credit points: 12.5

Coordinator: Prof Alan Hillier

Corequisites: 208-216 Food Microbiology.

Contact: Thirty-six hours of lectures and 24 hours of practicals and demonstrations *(Semester 2).*

Description: Microbes have been used in the food industry for centuries to extend shelf life and confer traits that alter the flavour, texture or nutritional value of the starting food materials. Improving the capability of microbes to perform their function has changed from natural selection of strains to targeted improvement through mutagenesis and the application of molecular biology techniques. This subject will provide an understanding of the principles involved in strain improvement and will include fundamentals of regulation and deregulation of biochemical pathways in microbes; mutagenesis and strain improvement methods; basic molecular biology techniques and their application in altering carbon flow in bacteria or protein synthesis; and current examples of manipulation of microbes and their use in the food industry.

On completion of this subject, students should be able to:

- describe how genes are regulated in microbes and the results of deregulation of these to produce particular traits, using classical mutagenesis or molecular genetic approaches;
- develop strategies for improving the performance of food microbes, based on models used currently in the food industry;
- understand the principles of molecular biology as applied to strain improvement for particular outcomes in the food industry; and
- source and analyse information from protein and DNA databases.

Assessment: One 2-hour examination (40% of final marks), one on-line practical examination (20%), one assignment, maximum 3000 words (20%) and preparation of practical reports (20%).

208-228 Waste Management and Use

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Mani Iyer

Prerequisites: 208-216 Food Microbiology.

Contact: Thirty-six hours of lectures and 24 hours practical work, demonstrations and site visits *(Semester 2).*

Description: Food production is increasingly concerned about minimising losses in production and processing, using all parts of starting materials as primary food products or composites, and extracting all valuable components in agricultural or processing by-products, including water for re-use. This includes developing new products that may have use in alternative sectors, including as pharmaceuticals, fuels, food and feed additives or as chemicals for a variety of different manufacturing sectors. The type of technologies that are applied to achieve waste minimisation and utilisation may rely on extraction, concentration, chemical modification or biological conversion via fermentation, or combinations of these approaches. This subject will explore the technologies involved in loss minimisation through case studies on processing specific commodities and where efficiencies are generated through waste management and use.

On completion of this subject, students should be able to:

- describe current and future technologies for minimising waste during food production, from farm to plate;
- understand the fate of materials across food production and product delivery, including flow into supply chains outside the food industry;
- describe concepts of water management and process design in context of processing specific agricultural commodities, particularly during processing, storage and delivery of food products;
- source information and prepare case studies on examples of good and bad practices in waste management;
- work alone and in groups in presenting information for discussion; and
- prepare reports and present these in written and oral form.

Assessment: One 2-hour examination (50% of final marks), one assignment, maximum 3000 words (20% of final marks), preparation of practical and site visit reports (20% of final marks), oral presentation of case studies (10% of final marks).

208-247 Biotechnology for Land and Food

See full subject details on page 3.

208-316 Oenology

See full subject details on page 4.

521-212 Biochemistry & Molecular Biology Part B

See full subject details on page 2.

521-220 Techniques in Protein & Gene Technology

See full subject details on page 2.

Third-year subjects

202-302 Human Resource Management

See full subject details on page 3.

208-310 Analytical Techniques

Availability: Gilbert Chandler campus

Credit points: 12.5

Coordinator: Dr Hubert Roginski

Contact: Five hours per week *(Semester 1).*

Description: The objective of this subject is to develop students' ability to:

- describe the physical, chemical and microbiological principles which underlie rapid and instrumental techniques for testing and analysing raw materials and finished products;
- evaluate innovative instrumental methods for specific purposes and materials against criteria of reliability and validity of results, and of cost and efficiency of monetary and labour resources; and
- select rapid or instrumental methods for analyses appropriate to the type of evaluation or assessment required.

Each of the following types of analytical techniques will be studied in line with the objectives outlined: physical, chemical, and microbiological parameters to be assessed; principles of instrumentation and/or methodology and applications of these principles to the technologies employed in analytical techniques; comparison of instrumental and/or rapid methods to conventional techniques of analysis; operation, calibration and standardisation procedures as applicable to particular techniques; assessment and evaluation of data derived from instrumental and/or rapid methods. Methods to be examined are chromatographic, TLC, HPLC, GLC; ion exchange separations; spectrophotometry, UV, visible, AA; mass spectrometry; serological techniques, FA, ELISA, monoclonal antibody; DNA and RNA technology, probes, PCR; electrophoretic separations; impedance; and industrial and research applications.

Assessment: Laboratory reports (20%); one 1-hour examination (mid-semester) (30%); one 2-hour examination (50%).

208-314 Technology of Food Processing

Availability: Gilbert Chandler

Credit points: 12.5

Coordinator: Dr Hubert Roginski

Prerequisites: 208-216 Food Microbiology, 208-225 Food Chemistry Biology and Nutrition

Contact: Thirty-six hours of lectures and 24 hours of practicals, demonstrations, site visits and computer-assisted learning (1st semester, year 3) *(Semester 1).*

Description: The subject provides a detailed analysis of the processing technologies used in food production and shelf-life extension, and the underlying scientific and engineering principles involved. This will include the role of packaging materials in product integrity and quality. Students will be introduced to the concept of quality management and automated process control. Practical exercises and demonstrations will allow students to have hands-on experience in commonly applied technologies. Case studies will be undertaken on selected production technologies to develop analytical skills for selecting and evaluating the most appropriate process for specific food groups or product development.

On completion of this subject, students should be able to:

- Describe the principles and application of food processing and preservation technologies
- Understand the principles of designing facilities for food production, including layout of equipment, provision of services, preventative maintenance, effective cleaning and sanitation processes
- Analyse processing technologies for their appropriate application in product development for consumer acceptance.

Assessment: Practical reports (20%). Two 2-hour examinations (one mid-semester) (40% each).

208-319 Trends in Food Science and Nutrition

Availability: Gilbert Chandler

Credit points: 12.5

Coordinator: Dr Hubert Roginski

Contact: Thirty-six hours of lectures and 24 hours practical, demonstration, site visits and computer-assisted learning *(Semester 2).*

Description: Many new technologies may influence food production in the future: some will be acceptable to consumers on the basis of lack of perceived risk, while others may be technologically sound but unacceptable to consumers. This subject will examine emerging technologies for food production, processing and preservation and the underlying scientific and engineering principles. This will include developing a greater understanding of nutritional and sensory analysis of foods, particularly where new product development involves novel functionality (such as conferring health benefits or new physical traits) or the interaction between food and packaging materials. Assignments will develop skills in critical analysis of the technologies, their possible application, risks associated with these and consumer views on these issues. Group assignments will be undertaken to develop skill in working with colleagues in critically analysing information on emerging biological, processing and engineering technologies that will influence new food product development.

On completion of this subject, students should be able to:

- Describe the scientific and technological principles underpinning emerging food processing technologies and their influence on food quality, safety and nutritional benefits
- Understanding the relationship between food additives and packaging materials in product development, functionality and shelf life extension
- Describe the theoretical and practical sceptics of sensory analysis
- Critically analyse emerging technologies in terms of their efficacy, suitability for particular application and potential risks in their application.

Assessment: Group assignment evaluation and oral presentation (20%); assignment of 3000 words (30%); two industry visit reports of 1000 words (10%); one 2-hour examination (40%).

Prescribed texts: P J Fellows, *Food Processing Technology*, 2nd edition, Woodhead Publishing Limited, Cambridge, 2000. • E Mary et al, *Food Product Development*, Woodhead Publishing Limited, Cambridge, 2001.

208-321 Food Safety, Quality and Regulation

Availability: Gilbert Chandler campus

Credit points: 12.5

Coordinator: Prof Margaret Britz

Prerequisites: 208-216 Food Microbiology and 208225 Food Chemistry, Biology and Nutrition.

Contact: Thirty-six hours of lectures and 24 hours of tutorials, group discussions on assignments and computer-assisted learning *(Semester 1).*

Description: A basic consumer requirement is that food must be safe and fit for human consumption, free from microbiological and chemical risk. Food production, processing and transport is a highly regulated system that engages many layers of government, from local councils, State and Federal authorities and international bodies. The nature of these organisations include quarantine, customs and excise (regulating the flow of biological materials across State and country boundaries); health (nutrition and food contamination management); and agriculture (safety of food production at farm level). This subject will provide an in-depth understanding of the regulatory framework locally and internationally for food, including environmental legislation that impacts on food production and trade. Assignments will engage students in exploring the nature of this regulatory system in context of food production and processing technologies.

On completion of this subject, students should be able to:

- describe the regulatory framework that governs the production of safe, nutritious and risk-free food products;
- understand risk assessment and the processes involved in meeting food standards;
- assess and evaluate information on the international regulatory and trade environment; and
- understand the complementarity of the regulatory system pre- and post-farm gate.

Assessment: One 2-hour examination (40%), two assignments, maximum of 3000 words each (each 25%) and oral presentation of case studies (10%).

208-322 Food Production Chain Management

Availability: Gilbert Chandler campus.

Credit points: 12.5

Coordinator: Prof Margaret Britz

Prerequisites: 208-321 Food Safety, Quality and Regulation.

Contact: Thirty-six hours of lectures and 24 hours of tutorials, group discussions on assignments and computer-assisted learning *(Semester 2).*

Description: Food production is increasingly becoming a system that provides efficient production at farm level and management of the delivery of food products into international trading markets. This subject should provide insight into the concept of food production chain management. This should include developing an understanding of the links needed between farm production, processing, packaging/transport and delivery of final products, marketing and the influence of consumer opinion on product consumption and successful product sale. This requires a knowledge of the regulatory environment that spans farm production, food processing and product formulation to standards and the structure of the local and international food industry. Students should learn the methodologies used to evaluate consumer views and apply these in case studies of successful and unsuccessful supply chains.

On completion of this subject, students should be able to:

- describe the characteristics of a supply chain and the operational points for management for successful product sales;
- understand and apply methodologies for evaluating consumer views;
- understand quality assurance and auditing framework needed for supply chain management;
- develop logistical plans for meeting consumer demands in terms of product quality and traits, in context of the regulatory environment; and
- source information and prepare case studies on examples of good and bad supply chain management practices.

Assessment: One 2-hour examination (50%), two assignments, maximum of 3000 words each (20%), and oral presentation of case studies (10%).

208-343 Food Science Project

Availability: Parkville and Gilbert Chandler campuses

Credit points: 12.5

Coordinator: Dr Said Ajlouni

Prerequisites: Completion of 1st and 2nd year of degree, or equivalent.

Contact: Twelve hours of lectures, plus class contact and seminars as arranged *(Semester 2).*

Description: This subject involves the definition and development of a laboratory-based or industry-related project which will develop skills in project planning and management, problem solving and report preparation. Students will undertake an investigation that may involve one of three types of studies centred around contemporary food industry issues or a particular food sector or company:

- A laboratory-based experimental investigation undertaken individually or in small groups, performed under academic supervision sometimes in conjunction with an industry-based supervisor. Six-hours per week laboratory access will be made available within the timetable for experimentation.
- A theoretical investigation not involving experimentation but including desk-top analysis of existing data or information available from the literature, undertaken either individually or in a group.
- An investigation of the operations of a particular company through an industry placement, supervised by an industry-based supervisor under guidance from an academic supervisor.

Students work interactively with the subject coordinator, academic or industry supervisor, and the class to define their topics and mode of project operations. Every student will prepare a project proposal that includes aims, methodologies and approaches, and covers the relevant chosen option. Individual students will submit a final report that includes a literature review and deliver an oral presentation at completion. Projects undertaken in groups will be evaluated through peer-review processes in addition to evaluation by supervisors.

Students will meet regularly as a group or electronically for guided, interactive discussion on their projects. Students are required to attend a series of seminars delivered on project design, management and communication strategies, including case studies.

Assessment: Oral presentation and peer evaluation (20%), final written report 5,000 words (70%), supervisor report on student performance (10%).