Physiology

Handbook 2020

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

MEDICAL AND HEALTH SCIENCES
SCHOOL OF MEDICAL SCIENCES

Why choose Physiology?

Physiology is, first and foremost, a science: it is concerned with how living organisms work.

Ultimately, understanding how living organisms work will allow us to understand what goes wrong in disease and provide a rational scientific basis for the treatment of disease. As a science, physiology depends on the acquisition of knowledge by observation and experiment, and the interpretation of experimental observations.

Of the biological sciences, physiology is highly quantitative in its approach and it also has close links with biochemistry, biophysics, molecular biology, mathematical modelling, pharmacology and zoology.

Mammalian physiology may be viewed as a cornerstone of scientific medicine and it is therefore not surprising that a large part of medical research worldwide is centred on physiology.

While Physiology is an important subject in its own right, it offers broad training in scientific and technical skills that naturally feed into other disciplines.

Physiology is an active and developing science which promises to remain one of the most exciting biological disciplines for the foreseeable future.

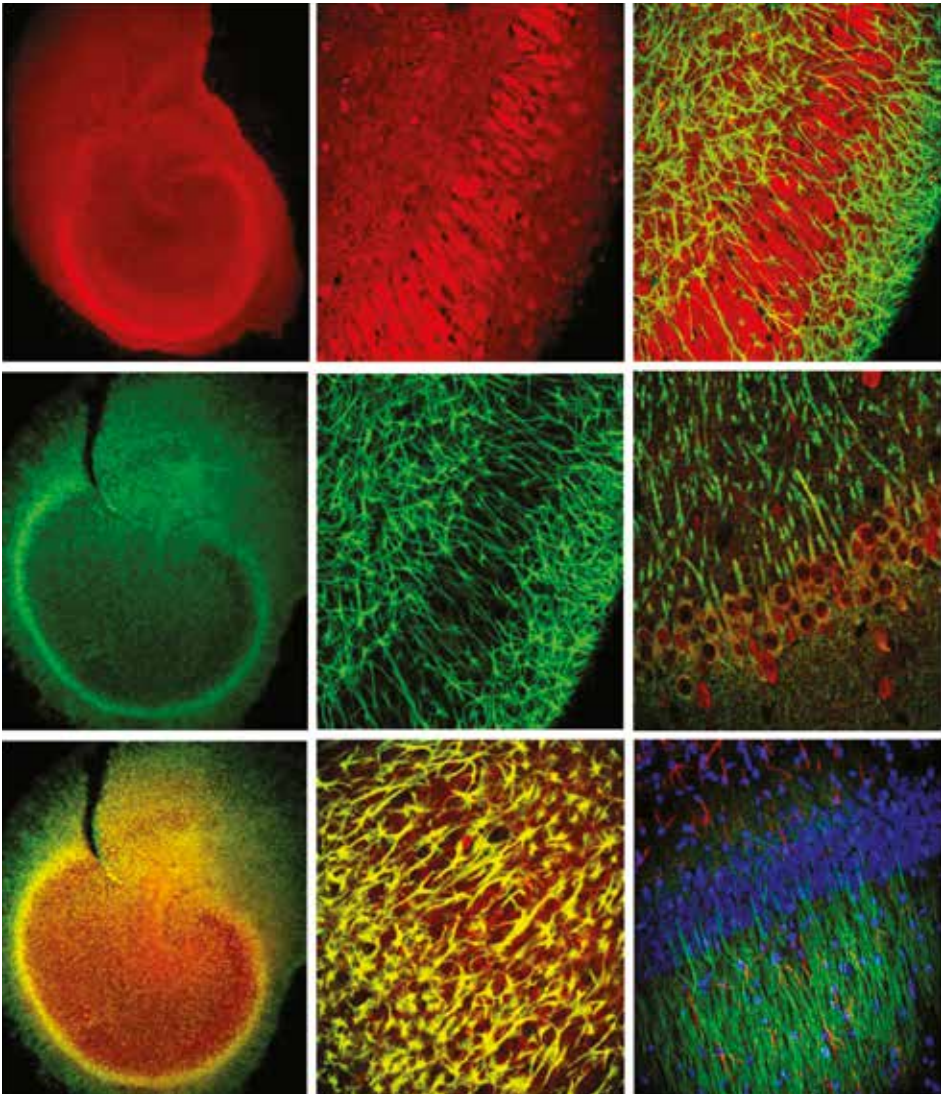
What do physiologists do?

Physiologists have many roles in society as physiology occupies a central place amongst the biological and medical sciences. Graduates with a physiology background are employed in a range of professions, including:

- Biomedical research (Universities, research institutes, commercial projects, government research centres)
- Industry research (biotechnology, pharmaceuticals, commercial etc.)
- Medical journalism and science communication
- Sports physiology

A background in physiology is also highly desirable for clinical professions such as:

- Audiology
- Medicine
- Optometry
- Veterinary medicine



Above: 'The panels of life' by J-Z Bai and J Lipski

Our department

We have broad teaching and research representation within the Faculty of Medical and Health Sciences and the Faculty of Science.

Our department has produced more than 45 research publications every year over the last five years. In addition, the research groups have had outstanding success in attracting competitive external research funds which provides an enormous impetus for our research programmes. This in turn fuels our research-led teaching ethos.

The advanced research-based teaching programmes and research-centric focus are a feature of our dynamic department.

Our staff and students

To deliver our innovative research-informed teaching we have:

- 18 full-time academic staff.
- 22 Research Fellows who are funded by national and international research contracts. Research Fellows also provide teaching services
- Seven professional staff and 10 research technicians.

Including our graduate students, the department consists of a team of more than 75 people who contribute to our teaching and research activities.

Our research

Physiology is a research-based science focused on studying how the body works, to advance understanding of human body systems, and identify what goes wrong in disease states.

The wide range of research carried out in our department is at the forefront of biomedical research internationally. We employ state of the art methods in our research to make new discoveries which have impact on human health and disease.

The discipline of Physiology has wide scope and application and there are many exciting opportunities to get involved in novel research having impact on the international stage.

Our research work is:

- Well funded by outside bodies such as the Health Research Council, Neurological Foundation, National Heart Foundation, New Zealand Lottery Grant Board, Marsden Fund and Deafness Research Foundation
- Usually a team effort involving people working together in research groups in the division
- Reported regularly at national and international conferences
- Published regularly in top quality, international, refereed journalsv

Research opportunities for students

Opportunities for undertaking research in physiology are available at the undergraduate and postgraduate levels, with work from such projects contributing to publications in international journals. Some research opportunities for students are listed below:

- Summer studentships
- Bachelor of Science (Hons)
- Bachelor of Biomedical Science (Hons)
- Master of Science
- Master of Biomedical Science
- Master of Audiology
- Master of Health Sciences
- PhD projects

The strengths of our programmes

- Our postgraduate physiology programmes deliver extensive research training and knowledge to ensure that our graduates develop skills in leadership and critical thinking.
- Our programmes offer opportunities to work with researchers who are international leaders in their field and conduct research in world-class laboratory research facilities.
- Our student research is directed towards current problems and is expected to contribute to publications in international journals of the highest quality.

Specific research areas

All research in our department is directed towards understanding fundamental mechanisms directly relevant to human and animal medicine.

Basal Ganglia Neurophysiology Laboratory

Professor J Lipski and Dr Peter Freestone

The aim of our research is to characterise the cellular and molecular mechanisms of neuronal damage occurring in Parkinson's disease and to study the modulation of neuronal activity within the basal ganglia network. Currently, we are focusing on the pathophysiology of dopaminergic neurons of the Substantia Nigra pars compacta which degenerate in this disease. In this neuronal group, we are studying the effects of parkinsonian toxins such as 6-hydroxydopamine, rotenone and MPTP. One of the main objectives is to test the hypothesis that damage of dopaminergic neurons is associated with activation of calcium channels and metabolic/oxidative stress. We also aim to improve treatments for Parkinson's disease using drugs which enhance dopamine production after levodopa (Ldopa) application.

Finally, we try to elucidate the role that endocannabinoids (cannabis-like substances that are produced naturally in the brain) play in regulating the activity of dopamine neurons. We take advantage of two new techniques: (1) optogenetics, which uses light to precisely activate specific brain cells; and (2) fast-scan controlled adsorption voltammetry (FSCAV) which we use to precisely measure the levels of extracellular dopamine. These techniques allow us to study the complex cell networks controlling dopamine production in greater detail than previously possible.

Translational Cardio-Respiratory Control Laboratory

Professor Julian Paton

My aspiration has been to discover novel physiological insights to inform new medical treatments for cardiorespiratory diseases such as hypertension, heart failure and sleep apnoea.

A case in point was when we unearthed that carotid body chemoreceptors generate aberrant afferent discharge in conditions of hypertension, and that this activity was causing blood pressure to rise through reflex activation of the sympathetic autonomic system. This led to the game-changing realisation that early on in the disease process, sensory afferent systems become dysfunctional in cardiorespiratory pathologies. Importantly, it created the opportunity to target them clinically as an effective treatment strategy.

My laboratory is testing the afferent activation hypothesis of sympathetic overdrive in disease. We are revealing the mechanisms associated with the development of aberrant afferent activity in peripheral chemoreceptor (carotid and aortic bodies), cardiac and skeletal muscle afferent systems in hypertension and heart failure. Recent work purports upregulation of a purinergic receptor located on the sensory terminals of these visceral afferents, which we are targeting with a novel small molecule in collaboration with Merck Pharmaceuticals. Our work spans from the transcriptomic level, single cell (voltage clamp and imaging), whole animal systems (fully instrumented chronic small and large animals) and testing in humans with cardiovascular disease.

Fetal Physiology and Neuroscience Group

Professor Alistair Gunn, Professor Laura Bennet

The group comprises physiologists and clinicians who have wide ranging biomedical research interests looking at the impact of oxygen deprivation before birth, how it causes injury and how that injury can be detected, prevented and/or treated. The team's research projects offer a substantial opportunity for students at all levels and emerging researchers to train in a multidisciplinary biomedical laboratory, to learn applied systems physiology, histology, immunohistochemistry and molecular biology techniques as well as get experience in applying basic biomedical science clinically. Laura's specialist interests are cardiovascular and cerebrovascular physiology and brain development. Her current research focus is on the impact of asphyxia on the very vulnerable preterm fetus.

Inner Ear Therapeutics

Associate Professor Srdjan Vlajkovic

The focus of this group is on cellular and molecular responses of the cochlea to stress and injury and novel therapeutic strategies to reduce the impact of hearing loss. Our aim is to characterise the role of oxidative stress, inflammation and glutamate excitotoxicity in the development of cochlear neuropathy and sensorineural hearing loss. Our current research incorporates a series of projects that directly investigate the protective role of adenosine receptor signalling on different forms of cochlear injury and hearing loss induced by noise, ototoxic drugs, cochlear implantation and ageing. These studies form a multidisciplinary programme of research to prevent, treat and reduce hearing impairment.

Circulatory control

Dr Carolyn Barrett and Dr Fiona McBryde

The focus of the Circulatory Control Laboratory is the control of blood pressure with particular regard to the mechanisms responsible for the development of hypertension and other cardiovascular diseases. The main approach of the laboratory is an integrated approach of monitoring of a number of cardiovascular variables such as blood pressure, sympathetic nerve activity, heart rate and blood flow for an extended period of time. Interests include the role of the sympathetic nervous system in the genesis of hypertension and the development of heart failure following myocardial Infarction.

Molecular neuroendocrinology

Associate Professor Kathy Mountjoy

POMC derived peptides and melanocortin receptor signalling

The physiological responses to pro-opiomelanocortin (POMC)-derived peptides include pigmentation, adrenal gland development and steroid hormone synthesis, food intake and feed efficiency, metabolism, body weight, insulin secretion immune and cardiovascular regulation. POMC and MC4R have been shown to be pivotal in the regulation of energy homeostasis. POMC, produced primarily in the pituitary and hypothalamus, is processed through a coordinated, tissue-specific series of proteolytic cleavages and post-translational modifications that influence the activity of the peptides. We are interested in how N-terminal acetylation of the POMC peptide enhances some activities (pigmentation, inhibition of food intake) of this peptide and virtually eliminates others. Our research involves the use of mutant and transgenic mice and cell lines either overexpressing or endogenously expressing melanocortin receptors and their accessory proteins.

Synaptic Function Research Group

Associate Professor Johanna Montgomery

Our primary research focus is in understanding the cellular and molecular mechanisms that guide the formation, maintenance, plasticity and elimination of excitatory synapses in the vertebrate central nervous system. We combine electrophysiological, molecular biology and imaging techniques to investigate the function of specific synaptic proteins, the molecular mechanisms of synaptic plasticity and how changes in synapse function or strength could manifest into network changes and disease.

Muscle cell function

Dr Marie Ward

Cytoplasmic calcium (Ca^{2+}) concentration underlies many important physiological activities, including muscle contraction. My research interest is in the cellular and molecular factors involved in the control of muscle function. In particular, my research focuses on the dynamic, yet delicate balance of intracellular Ca^{2+} within cardiac muscle cells. Variations in this Ca^{2+} balance are crucial to physiological and pharmacological mechanisms that increase the force of contraction in the heart. Disturbances of intracellular Ca^{2+} handling can be responsible for pathological states (e.g. incomplete relaxation between beats and the generation of cardiac arrhythmias).

Brain Development and Repair Group

Dr Justin Dean

My aim is to characterise the molecular and cellular mechanisms underlying the impairments in white matter and cortical maturation that occur following preterm birth. My current focus includes:

- Astrogliosis as an inhibitory environment for cell plasticity
- Oligodendrocyte cell biology and responses to injury
- The physiological and pathophysiological roles of the extracellular matrix glycosaminoglycan hyaluronic acid in oligodendrocyte progenitor cell (OPC) proliferation and maturation
- Impact of prenatal insults on cortical development and neuronal maturation
- Glial/axonal signaling
- The use of high-field strength MRI for imaging of brain injury

The overall goal is to develop therapeutic strategies targeted to overcome oligodendrocyte injury and myelination deficits and impaired cortical maturation that occur following infection or cerebral hypoxia-ischemia in the developing brain.

Cellular and molecular cardiology

Dr Kimberley Mellor

Understanding the mechanisms of cardiac dysfunction in disease states is a key priority for developing targeted interventions for therapeutic applications. Heart failure, cardiac hypertrophy and diabetes are major contributors to mortality and morbidity. By linking disturbances in cell death processes, intracellular structural organisation and molecular adaptations with functional disturbances in these disease settings, key targets for intervention can be identified. These investigations are undertaken at the whole body, whole organ and single cell level.

CardioRenal Physiology Group

Dr Rohit Ramchandra

We are interested in the autonomic control of the cardiovascular system. The emphasis of projects is on control of the circulation during normal physiological situations as well as impaired control during cardiovascular disease. Despite significant therapeutic advances, morbidity and mortality in patients suffering from cardiovascular disease remain unacceptably high.

Patients with cardiovascular disease have a large increase in the activity of the sympathetic nerves

to various organs including the heart and the kidney, and this increased activity is detrimental and associated with poor prognosis in these patients. Current treatments have a large number of side effects in patients and the focus of the lab is identifying novel treatment paradigms to reduce the detrimental increase in sympathetic drive.

Molecular Vision Laboratory

Professor Paul Donaldson, Dr Julie Lim and Dr Gus Grey

The Molecular Vision Laboratory has extensive molecular and cellular expertise in the general field of membrane transport. Members of the laboratory utilise electrophysiology, functional imaging, biochemistry, imaging mass spectrometry, molecular biology and computer modelling to determine how the properties of ion channels and transporters contribute to the integrative function of ocular tissues that comprise the front of the eye. Current research projects in the lens are focused on determining how the interaction of a variety of ion channels and transporters contribute to the maintenance of lens transparency and their dysfunction result in lens cataract, the leading cause of blindness in the world today.

Perinatal Molecular Neuroscience Research Group

Associate Professor Mhoyra Fraser

Investigating perinatal brain development and strategies to prevent or treat brain damage in vulnerable newborns.

Studies to advance our understanding of the complex mechanisms which link preterm brain injury to infection/inflammatory processes

Being born too early and too small is associated with severe and debilitating consequences. At least half the survivors have neurodevelopmental problems that affect their daily life while 15% develop severe problems such as cerebral palsy. The cause of this injury is unclear and there is no current treatment. Hypoxia-ischaemia caused by a lack of oxygen to the brain or infection of the brain originating from the placenta and fetal membranes are major contributors to injury of the preterm brain. Currently, we are investigating how infection and hypoxia-ischaemia damages the brain with the goal of preventing or alleviating damage in these vulnerable babies.

Studies to evaluate whether microRNAs can serve as biomarkers for risk of preterm brain injury

Preterm babies have very high risks of long-lasting disability, including cerebral palsy. Unfortunately this is usually apparent long after birth at a time when treatment is not possible. A minimally invasive method of early detection would allow early intervention. In pilot studies we found that small amounts of genetic material (so called 'microRNAs') are released by the brain into the blood after low oxygen levels. We are currently investigating whether key microRNAs would provide a robust signal to identify babies at risk of disability.

Cardiac Nanobiology Group

Dr David Crossman

My research is focused on understanding the pathological remodelling of the macro-molecular complexes that regulate cardiac muscle cell contraction in particular the transverse(t)-tubules. My work in this field includes one of the first quantitative confocal analyses of t-tubules and associated Ca2+ release channels in the failing human heart. Subsequently, I went on to demonstrate that contractile function in the failing human heart (measured by MRI) was strongly correlated to the amount of transverse tubules measured by confocal microscopy work that was highlighted by editorial in Journal of Molecular and Cellular Cardiology.

Most recently, using mass-spectrometry and super resolution microscopy, I have identified for the first time that there is increased collagen within the dilated t-tubules in human heart failure. This work featured on the cover of Cardiovascular Research and received expert editorial highlighting the novel hypothesis that fibrosis is a mechanism of t-tubule remodelling.

Human Cardiorespiratory Physiology

Associate Professor James Fisher

My research broadly concerns the autonomic nervous system regulation of the heart and blood vessels in humans. Through collaboration with academic colleagues using animal models and hospital-based clinicians, this work seeks to provide new insights into cardiovascular conditions, such as hypertension, heart failure and atrial fibrillation, which are a leading cause of morbidity and mortality both globally and in New Zealand.

Heightened sympathetic activity to the heart and blood vessels is implicated in the initiation and progression of a number of cardiovascular diseases. Moreover, patients in whom autonomic dysregulation is established can suffer from skeletal muscle hypoperfusion, premature fatigue and breathlessness upon physical exertion. My work in this area seeks to better understand the mechanisms that trigger and maintain sympathetic hyperactivity, and to develop novel effective therapeutic strategies as current medication fails to normalise sympathetic tone. These studies involve direct intraneural recordings of sympathetic activity in humans (microneurography) in combination with real-time measures of regional blood flow, blood pressure, heart function and ventilation in order to comprehensively characterize the dynamic and integrative nature of cardiorespiratory physiology in human health and disease.

Our courses and programmes

Bachelor of Science (BSc) – Physiology major

First or single major must include:

- At least 60 points from MEDSCI 309-312, 316, 317

Second major must include:

- At least 45 points from MEDSCI 309-312, 316, 317

Stage I courses

While courses in Physiology are not offered explicitly at Stage I, the Department of Physiology makes a major contribution to introductory courses at this level. Students wishing to pursue a degree in Physiology (or closely related subjects) are strongly advised to complete the following Stage I courses:

- BIOSCI 106, BIOSCI 107, CHEM 110, MEDSCI 142, PHYSICS 160

Of the above, BIOSCI 107 and MEDSCI 142 are prerequisites for Stage II Physiology courses. The other courses will facilitate further study in physiology (as well as other biomedical sciences). The prospective student should also have competency in mathematics to NCEA Level 3. If this is not the case, taking an appropriate mathematics course is highly advisable.

Bachelor of Science (Honours) (BSc(Hons)) – Physiology specialisation

Prerequisite

BSc with a major in Physiology, 90 points at stage III and a B average in at least 45 points of Stage III Physiology courses.

Requirements:

- 30 points: MEDSCI 733, 743
- 30 points from MEDSCI 701 or MEDSCI 744 MEDSCI 703, 717, 727 - 732, 734, 737, 739
- 60 points: PHYSIOL 787 Dissertation

Postgraduate Diploma in Science (PGDipSci) – Physiology specialisation

Prerequisite

A BSc with a major in Physiology, or equivalent qualification including at least 45 points from MEDSCI 309-317

Requirements

- 30 points: MEDSCI 733, 743
- 90 points from MEDSCI 701 or MEDSCI 744, 703, 717, 727-734, 737, 739

Master of Science (MSc) – Physiology specialisation

Prerequisite

- A BSc(Hons) or PGDipSci in Physiology

Requirement

- 120 points: PHYSIOL 796 MSc Thesis in Physiology

Stage II courses – undergraduate

Course	Title	Points	Academic Director	Prerequisites
MEDSCI 205	The Physiology of Human Organ Systems	15	Rohit Ramchandra	BIOSCI 107 MEDSCI 142 GPA >2.5
MEDSCI 206	Introduction to Neuroscience	15	Johanna Montgomery	BIOSCI 107 MEDSCI 142 GPA >2.5

Stage III courses – undergraduate

Course	Title	Points	Academic Director	Prerequisites
MEDSCI 309	Biophysics of Nerve and Muscle	15	Marie Ward	MEDSCI 205 or 206 GPA >5.0
MEDSCI 311	Cardiovascular Biology	15	Laura Bennet Anuj Bhargava	B Grade in MEDSCI 205 GPA >4.5
MEDSCI 312	Endocrinology of Growth and Metabolism	15	Kathy Mountjoy	30 points from BIOSCI 203, MEDSCI 201, 205 GPA >5.0
MEDSCI 316	Sensory Neuroscience: From Molecules to Disease	15	Srdjan Vlajkovic	MEDSCI 206 GPA >4.5
MEDSCI 317	Integrative Neuroscience: From Fetus to Adult	15	Justin Dean	MEDSCI 206 GPA >4.5

Postgraduate courses

Course	Title	Points	Academic Director	Prerequisites
MEDSCI 727	Advanced Neuroscience: Neurophysiology	15	Janusz Lipski	MEDSCI 206, 317
MEDSCI 729	Perinatal and Physiology	15	Mhoyra Fraser	MEDSCI 312
MEDSCI 732	Molecular Aspects of Endocrinology and Metabolism	15	Kathy Mountjoy	
MEDSCI 733	Advanced Methods in Cell Physiology	15	Johanna Montgomery	
MEDSCI 734	Advanced Integrative Physiology	15	Kim Mellor	Prefer MEDSCI 311
MEDSCI 739	Advanced Sensory Neuroscience	15	Srdjan Vlajkovic	MEDSCI 316
MEDSCI 743	Design and Analysis in Biomedical Research	15	Rohit Ramchandra	

Course content: Undergraduate

MEDSCI 205
The Physiology of Human Organ Systems

15 points | Semester One, Grafton

Assessment

Final exam	65%
Mid-semester test	15%
Lab reports	20%

Description

An integrative approach is used to study fundamental physiological processes which enable the body to overcome the challenge of life. Drawing on examples of normal and abnormal function, the course examines the interaction of vital physiological processes, from cellular control mechanisms to multiple organ systems. Topics include: control of fluid and electrolytes, cardiovascular control, energy use and the delivery of oxygen and metabolites.

Prerequisite: BIOSCI 107, MEDSCI 142, GPA 2.5

Restriction: PHARMACY 205

Course director: Dr Rohit Ramchandra

MEDSCI 206
Principles of Neuroscience

15 points | Semester Two, Grafton

Assessment

Final exam	65%
Module A test	10%
Module B test	10%
Lab assignments	15%

Description

The impact of neuroscience revolution on our understanding of human physiology and biomedical research is reviewed. Topics include: mechanisms of neurotransmission, learning, memory, sensory perception (vision, hearing, touch and smell) and application of gene therapy for treating neurological diseases. Special emphasis is placed on the integration and control of physiological function by the nervous system. Examples include control of movement and coordination, regulation of reproduction, blood pressure, breathing, appetite, body weight and sexuality. Developmental neuroscience is also considered. Laboratory exercises provide insight into neural structure and function and include application of neuroimaging technologies.

Prerequisite: BIOSCI 107, MEDSCI 142, GPA 2.5

Course director: Associate Professor Johanna Montgomery

MEDSCI 309
Biophysics of Nerve and Muscle

15 points | Semester Two, Grafton

Assessment

Final exam	60%
Mid-semester test	15%
Laboratory reports and numerical problems	25%

Description

An advanced treatment of the physiology of excitable cells. Topics include: the biophysical basis of membrane potential, the spread of electrical activation and synaptic transmission, structure, excitation, mechanics and energetics of muscle and functional differences among muscle types. The approach is quantitative with particular emphasis on current advances in the field.

Prerequisite: MEDSCI 205, 206, or for BE(Hons) students, 15 points from MEDSCI 205 and 15 points from courses at Stage II listed in Part II of the Biomedical Engineering specialisation in the BE(Hons) Schedule. GPA 5.

Course director: Dr Marie Ward

MEDSCI 311
Cardiovascular Biology

15 points | Semester One, Grafton

Assessment

Final exam	60%
2 lab reports, 1 lab presentation	20%
Essay	10%
Mid-semester test	10%

Description

An advanced treatment of the human cardiovascular system that provides an integrated framework for understanding the structure, function and regulation of the heart and circulation and their modification by drugs. Topics include: the energetics and mechanics of the heart, the regulation of heart rhythm and the control of blood pressure and the regulation of flow through the microcirculation. The course is illustrated using examples drawn from current research in the field and from representative disease states.

Prerequisite: B grade in MEDSCI 205, GPA 4.5

Course director: Professor Laura Bennet

MEDSCI 312
Endocrinology of Growth and Metabolism

15 points | Semester Two, Grafton

Final exam	65%
Test	15%
Lab	20%

Description

An introduction to the mechanism controlling the production of hormones and how these achieve their effects in regulating body function. The course focuses in particular on the hormone systems controlling growth and metabolism and contrasts the differences between fetal and adult life. It also highlights how defects in endocrine systems are associated with conditions such as obesity and diabetes.

Prerequisite: 30 points from BIOSCI 203, MEDSCI 201, 205. GPA 5

Course director: Associate Professor Kathy Mountjoy

MEDSCI 316
Sensory Neuroscience: From Molecules to Disease

15 points | Semester One, Grafton

Final exam	60%
Test	10%
Lab reports	30%

Description:

The physiology of neurosensory systems in health and disease with an emphasis on clinical relevance and current advances in research. The course will provide in-depth coverage of mechanisms involved in each system from a broad systemic level down to the molecular level. Topics include vision, hearing, balance, olfaction, taste, touch and pain.

Prerequisite: MEDSCI 206. GPA 4.5

Restriction: MEDSCI 310

Course director: Associate Professor Srdjan Vlajkovic

MEDSCI 317
Integrative Neuroscience: From Fetus to Adult

15 points | Semester Two, Grafton

Final exam	60%
Mid-semester test	10%
Mini review	10%
Lab report	20%

Description

The development and function of the central nervous system in health and disease. Topics include development of the CNS, functional imaging of the human brain, synaptic function in health and disease, development and pathophysiology of motor systems, perinatal and adult brain ischemia, stroke and sleep related disorders. The topics are covered at an advanced level with emphasis on current advances in the fields.

Prerequisite: MEDSCI 206. GPA 4.5

Restriction: MEDSCI 310

Course director: Dr Justin Dean

Course content: Postgraduate

MEDSCI 727 Advanced Neuroscience: Neurophysiology

15 points | Semester One, Grafton

Final exam	60%
Assignments	30%
Oral presentation	10%

Description

An advanced treatment of selected topics in neurophysiology and brain pathophysiology. Involves presentations and critical analysis by the students of the current scientific literature within the context of several major research themes that encompass models from molecular and cellular to systems level.

Themes will be selected from the following areas:

(1) motor control and motor disorders;
(2) synapse physiology and pathophysiology;
(3) advances in neural stem cell research; and
(4) physiology and pathophysiology of CNS glia.

Prerequisite: MEDSCI 206, 317

Course director: Professor Janusz Lipski

MEDSCI 729 Perinatal Physiology and Medicine

15 points | Semester One, Grafton

Final exam	60%
Seminar	10%
Essays	30%

Description

Fetal development has long-term consequences for health. This advanced course offers a wide range of research themes relating to fetal development and future health. Topics include: placental development, fetal physiology, and endocrine regulation and metabolic function during fetal and postnatal life. The course explores pathogenesis of disease and injury of the fetus and newborn, and how biomedical research leads to potential clinical treatment strategies.

Prerequisite: MEDSCI 312

Course director: Associate Professor Mhoyra Fraser

MEDSCI 732
Molecular Aspects of Endocrinology and Metabolism

15 points | Semester Two, Grafton

Final exam	60%
Coursework	40%

Description:

Explores how hormones are able to control such a wide range of physiological processes. Covers molecular aspects of hormone action with particular reference to the neuroendocrine and peripheral endocrine systems that control appetite and metabolism. Other topics covered include how defects in hormone action lead to diseases such as cancer, obesity, Type-2 diabetes and cardiovascular disease.

Course director: Associate Professor Kathy Mountjoy

MEDSCI 733
Advanced Methods in Cell Physiology

15 points | Semester One, Grafton

Test 1	25%
Report optics module	10%
Final test	50%
Assignment 3	10%
Assignment 1	5%

Description

The theoretical basis underpinning electrophysiological and live cell imaging techniques used to probe cellular function will be addressed. Emphasis will be placed on the instrumentation, data acquisition and data analysis associated with each technology. The approach is practical and computer-based software programmes are used to analyse pre-recorded data and data produced by the students themselves.

Restriction: MEDSCI 726

Course director: Associate Professor Johanna Montgomery

MEDSCI 734
Advanced Integrative Physiology

15 points | Semester Two, Grafton

Seminar	15%
Essays	60%
Test	20%
Active Participation	5%

Description

In the post-genomic world the limitations of reductionism as a basis for understanding complex function have become apparent and it is necessary to integrate genomics with the biology of organ systems. This course will portray how an integrative physiological approach can reveal new levels of understanding in the field of biomedical research. Examples of this approach will be drawn from research programmes within the areas of cardiovascular biology, fetal physiology, neurophysiology and vision.

Restriction: MEDSCI 728

Course director: Dr Kim Mellor

MEDSCI 739
Advanced Sensory Neuroscience

15 points | Semester Two, Grafton

Final exam	50%
Oral presentation	20%
Assignments	30%

Description

Advanced study of the physiology of neurosensory systems in health and disease. Provides an in-depth coverage of the molecular, cellular and systematic mechanisms underlying vision and hearing.

Prerequisite: MEDSCI 316

Course director: Associate Professor Srdjan Vlajkovic

MEDSCI 743
Design and Analysis in Biomedical Research

15 Points | Semester One, Grafton

Description

An in-depth exploration of the principles of experimental design and data analysis in biomedical contexts. A focus on critical appraisal of choice of statistical tests to address experimental questions and appropriateness and limitations of analysis and interpretation of results will be undertaken. Practical and computer statistical packages are used.

Restriction: MEDSCI 725

Course director: Dr Rohit Ramchandra

MEDSCI 744
Project Design in Biomedical Science

15 Points | Semester One & Two, Grafton

Preliminary proposal assignment	10%
Research proposal	65%
Oral presentation	25%

Description

An individualised course of study in which each student will provide an exposition of the background to a specific research question in the biomedical sciences combined with a proposal of the best methods to investigate that specific question. A holistic consideration, including the ethical, regulatory, budgetary as well as any other relevant aspects of the chosen methods will be documented.

Prerequisite: 30 points from Medical Science at Stage III or higher with a B- or better

Restriction: BIOSCI 761, MEDSCI 701, OBSTGYN 705

Course director: Dr Scott Graham and Dr Julie Lim

Physiology pathway

BSc(Hons), PGDip, Masters and PhD planner

BScPhysiology

BSc(Hons)
2 semesters courses + research

Prerequisites

A major in Physiology, at least 90 points at Stage III and at least 45 points from MEDSCI 309-317

Requirements

- 30 points: MEDSCI 733, 743
- 30 points: MEDSCI 701 (or 744), 703, 717, 727-732, 734, 737, 739
- 60 points: PHYSIOL 787 Dissertation

PGDipSci
2 semesters courses only

Prerequisites

BSc with a major in Physiology, or equivalent qualification including at least 45 points from MEDSCI 309-317.

Requirements

- 30 points: MEDSCI 733, 743
- 90 points: MEDSCI 701 (or 744), 703, 717, 727-732, 734, 737, 739

Masters of Science (MSc)
1 year research only

Prerequisites

A BSc(Hons) or PGDipSci in Physiology, or equivalent.

Requirements

120 points: PHYSIOL 796 MSc Thesis

PhD
3-4 years research only

Requirements

Research project and oral exam

2020 Bachelor of Science degree planner

Major(s): Physiology

YEAR ONE	BIOSCI 107	MEDSCI 142	CHEM 110, PHYSICS 120 or 160	Any stage Science	Any stage Science
YEAR TWO	MEDSCI 205	MEDSCI 206	MEDSCI 201, 203 or 204	Stage II/III Science	Stage II/III Science
YEAR THREE	MEDSCI 309, 311, 312, 316 or 317	MEDSCI 309, 311, 312, 316 or 317	MEDSCI 309, 311, 312, 316 or 317	Capstone PHYSIOL 399	Stage III Science

BSc requires 360 points (24 x 15-point courses). Each box represents one 15 point course. (
It is the student's responsibility to check that the final pr

Notes:

Course(s) taken but not contributing to BSc:

SEE THE SCIENCE STUDENT CENTRE FOR DEGREE PLANNING ADVICE

Room G20, Building 301, 23 Symonds Street, The University of Auckland
Email: scifac@auckland | www.science.auckland.ac.nz

ID	Name
Date	Science Student Centre

Any stage Science	Any stage Science	Any stage or module	ACADINT A01 (S1/S2)
Any stage Science	Gen Ed	Any stage or module	
Stage II/III Science	Gen Ed	Stage II/III Science or module	

◆ Current enrolment
★ Required course
✓ Completed Course

S1: Semester 1
S2: Semester 2
SS: Summer School

ACADINT A01 is a short online course worth zero points)
ogramme complies with University Calendar Regulations.

Major/specialisation information

1. Courses in a minimum of three subject codes listed in the BSc Schedule.
2. At least 180 points (12 courses) must be above Stage I.
3. At least 75 points must be at Stage III, of which 45 points must be in the majoring subject, and 15 points from a capstone course listed in the BSc Schedule.
4. 30 points (2 courses) must be taken from the appropriate General Education Schedules for BSc students.
5. Up to 30 points (2 courses) may be taken from outside the Faculty.

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SCIENCE

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Ravindra Telang, BVSc&AH Bom., MVSc PhD IVRI (jointly with Audiology)

Guido Wassink MSc, PhD

Annika Winbo MD OhD *Umea*

Emily Bardsley

Dates to remember

Semester One – 2020

Semester One begins	Monday 2 March
Mid-semester break/Easter	Monday 10 – Monday 27 April
ANZAC Day	Monday 27 April
Graduation	Monday 7, Wednesday 9, Friday 11 May
Queen's Birthday	Monday 1 June
Lectures end	Friday 12 June
Study break	Monday 15 – Wednesday 17 June
Examinations	Thursday 11 June – Monday 29 June
Semester One ends	Monday 6 July
Inter-semester break	Tuesday 7 July – Friday 24 July

Semester Two – 2020

Semester Two begins	Monday 27 July
Mid-semester break	Monday 7 September – Friday 18 September
Graduation	Tuesday 28 September
Lectures end	Friday 30 October
Study break	Monday 2 – Wednesday 4 November
Labour Day	Monday 26 October
Examinations	Thursday 5 November – Saturday 21 November
Semester Two ends	Sunday 22 November

Contact us

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