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.

Why choose Physiology?

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

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 journals

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.
**Muscle energetics**

**Associate Professor Denis Loiselle**

Whether working or resting, muscles expend metabolic energy. It is the aim of muscle energetics to understand the manifold energy pathways that run from sources in glycolysis and oxidative phosphorylation to sinks in the various ATPases that support excitation, activation and contraction. By understanding energy supply and demand we hope to clarify how various essential processes in the cell interact to maintain cell function. Methodologies range from calorimetry to intracellular ion measurement.

**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:

- Astroglia 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 structure and function

Associate Professor Ian LeGrice

Research in this area is focused on the structure of the heart and how this influences both the spread of cardiac electrical activation and the mechanical performance of the heart. Current projects include experimental and computer modelling studies of the way in which the changing structure of the atria and ventricles in disease states lead to altered electrical and mechanical function of the heart. These investigations require the development of innovative imaging equipment and techniques. A significant focus of the work in our laboratory currently is the development of a new 3D microscopic imaging system and associated tissue processing techniques, and new approaches to intracardiac electrophysiological mapping.

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.
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, 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, 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Points</th>
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<th>Prerequisites</th>
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<tbody>
<tr>
<td>MEDSCI 205</td>
<td>The Physiology of Human Organ Systems</td>
<td>15</td>
<td>Rohit Ramchandra</td>
<td>BIOSCI 107, MEDSCI 142 GPA &gt;2.5</td>
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<tr>
<td>MEDSCI 206</td>
<td>Introduction to Neuroscience</td>
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## Stage III courses – undergraduate

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<tr>
<td>MEDSCI 309</td>
<td>Biophysics of Nerve and Muscle</td>
<td>15</td>
<td>Marie Ward</td>
<td>MEDSCI 205 or 206 GPA &gt;5.0</td>
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<tr>
<td>MEDSCI 311</td>
<td>Cardiovascular Biology</td>
<td>15</td>
<td>Laura Bennet, Anuj Bhargava</td>
<td>B Grade in MEDSCI 205 GPA &gt;4.5</td>
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<tr>
<td>MEDSCI 312</td>
<td>Endocrinology of Growth and Metabolism</td>
<td>15</td>
<td>Kathy Mountjoy</td>
<td>30 points from BIOSCI 203, MEDSCI 201, 205 GPA &gt;5.0</td>
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<tr>
<td>MEDSCI 316</td>
<td>Sensory Neuroscience: From Molecules to Disease</td>
<td>15</td>
<td>Srdjan Vlajkovic</td>
<td>MEDSCI 206 GPA &gt;4.5</td>
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<tr>
<td>MEDSCI 317</td>
<td>Integrative Neuroscience: From Fetus to Adult</td>
<td>15</td>
<td>Justin Dean</td>
<td>MEDSCI 206 GPA &gt;4.5</td>
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## Postgraduate courses

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<th>Prerequisites</th>
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<tbody>
<tr>
<td>MEDSCI 727</td>
<td>Advanced Neuroscience: Neurophysiology</td>
<td>15</td>
<td>Janusz Lipski</td>
<td>MEDSCI 206, 317</td>
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<tr>
<td>MEDSCI 729</td>
<td>Perinatal and Physiology</td>
<td>15</td>
<td>Mhoyna Fraser</td>
<td>MEDSCI 312</td>
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<tr>
<td>MEDSCI 732</td>
<td>Molecular Aspects of Endocrinology and Metabolism</td>
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<td>MEDSCI 733</td>
<td>Advanced Methods in Cell Physiology</td>
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<td>MEDSCI 734</td>
<td>Advanced Integrative Physiology</td>
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<td>Janusz Lipski, Kim Mellor</td>
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<td>MEDSCI 739</td>
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<td>MEDSCI 743</td>
<td>Design and Analysis in Biomedical Research</td>
<td>15</td>
<td>Rohit Ramchandra</td>
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**MEDSCI 205**
The Physiology of Human Organ Systems

15 points | Semester One, Grafton

**Assessment**

<table>
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<th>Component</th>
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<tbody>
<tr>
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<tr>
<td>Mid-semester test</td>
<td>15%</td>
</tr>
<tr>
<td>Lab reports</td>
<td>20%</td>
</tr>
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</table>

**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

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**MEDSCI 206**
Principles of Neuroscience

15 points | Semester Two, Grafton

**Assessment**

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<tbody>
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<td>Module B test</td>
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<tr>
<td>Lab assignments</td>
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</table>

**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**

<table>
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<tbody>
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<tr>
<td>Mid-semester test</td>
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<tr>
<td>Laboratory reports and numerical problems</td>
<td>25%</td>
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</table>

**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**

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<th>Component</th>
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<tbody>
<tr>
<td>Final exam</td>
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<tr>
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<td>Mid-semester test</td>
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**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 70%
Test 10%
Lab reports 20%

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
## MEDSCI 727
### Advanced Neuroscience: Neurophysiology

<table>
<thead>
<tr>
<th>15 points</th>
<th>Semester One, Grafton</th>
</tr>
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<tbody>
<tr>
<td>Final exam</td>
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<td>Assignments</td>
<td>30%</td>
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<tr>
<td>Oral presentation</td>
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**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

<table>
<thead>
<tr>
<th>15 points</th>
<th>Semester One, Grafton</th>
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<tbody>
<tr>
<td>Final exam</td>
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<td>Seminar</td>
<td>10%</td>
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<tr>
<td>Essays</td>
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**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

Oral 20%
Essays 80%

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: Professor Janusz Lipski / 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

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Preliminary proposal assignment</td>
<td>10%</td>
</tr>
<tr>
<td>Research proposal</td>
<td>65%</td>
</tr>
<tr>
<td>Oral presentation</td>
<td>25%</td>
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</table>

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

**BSc(Hons)**

- **Prerequisites**
  A major in Physiology and at least 90 points at Stage III.

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

**PGDip**

- **Prerequisites**
  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, 703, 717, 727-734, 737, 739

**Masters**

- **Prerequisites**
  A BSc(Hons) or PGDipSci in Physiology

- **Requirements**
  120 points: PHYSIOL 796 MSc Thesis in Physiology

**PhD**

- PhD Research Thesis and Oral exam
BSc degree planner – Physiology

To view regulations for majors, and course descriptions, see [www.calendar.auckland.ac.nz](http://www.calendar.auckland.ac.nz). The BSc degree requires: 360 points (24 x 15 point courses). Each box represents one 15 point course. It is recommended that students enrol in 8 courses each year.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>BIOSCI 101 (S1) (recom)</th>
<th>BIOSCI 106 (S2) (recom)</th>
<th>BIOSCI 107 (S1) (recom)</th>
<th>MEDSCI 142 (S2) (recom)</th>
<th>CHEM 110 or 120 (S1 or S2) (recom)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>With appropriate prerequisites can also be filled by Stage II or III.</td>
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</table>

| Year 2 | BIOSCI 203 (S2) (recom) | MEDSCI 201 (S1) (recom) | MEDSCI 205 (S1) (recom) | MEDSCI 206 (S2) (recom) | |
|--------|-------------------------|-------------------------|-------------------------|-------------------------||

| Year 3 | MEDSCI 308-312, 316, 317 | MEDSCI 308-312, 316, 317 | MEDSCI 308-312, 316, 317 | MEDSCI 308-312, 316, 317 | |
|--------|-------------------------|-------------------------|-------------------------|-------------------------||

Stage III Science

1. Courses in a minimum of three subjects listed in the BSc Schedule.
2. At least 180 points (12 courses) must be above Stage 1.
3. Up to 30 points (2 courses) may be taken from outside the Faculty.

It is the student’s responsibility to check that the final programme complies with University Regulations. The Faculty of Science is the final authority on all BSc regulations.
4. 30 points (2 courses) must be taken from the appropriate General Education Schedules for BSc students.
5. At least 75 points must be at Stage III, of which 60 points must be in the majoring subject.

Consult with University Regulations. The Faculty of Science is the final authority.
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Joanne Davidson  BSc(Hons), PhD
Angus Grey  BTech(Hons), PhD
Sarah-Jane Guild  ME, PhD
Julie Lim  MSc, PhD
Fiona McBryde  BSc(Hons) PhD

Research Fellows

Yonis Abukar  BBiomed Sci, PhD Melb
Jesse Ashton  ME, PhD
Meagan Barclay  BSc(Hons) PhD
Juliette Cheyne  BSc(Hons), PhD
Lorna Daniels  BSc MSc, PhD
Peter Freestone  BSc(Hons), PhD
Yewon Jung  BSc(Hons), PhD
Chris Lear  BSc(Hons), PhD
Kevin Lee  BSc(Hons), PhD
Bianca Maceo Heilman  BSc(Hons), PhD
Rashika Karunasinghe  MSc, PhD
Yoshinori Maeda  MD
Rosica Petrova  MSc, PhD
Himani Sumudu Ranasinghe
Ravindra Telang, BVSc&AH Bom., MVSc PhD IVRI (jointly with Audiology)
Guido Wassink  MSc, PhD
Michi Kasai  MD
## Dates to remember

<table>
<thead>
<tr>
<th>Academic year 2018*</th>
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<tbody>
<tr>
<td><strong>Summer School – 2018</strong></td>
</tr>
<tr>
<td>Lectures begin</td>
</tr>
<tr>
<td>Auckland Anniversary Day</td>
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<tr>
<td>Waitangi Day holiday</td>
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<tr>
<td>Lectures end</td>
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</tbody>
</table>
| Study break/exams | **Study Break:** Saturday 10 February  
**Exams:** Monday 12 - Wednesday 14 February |
| Summer School ends | Wednesday 14 February |

<table>
<thead>
<tr>
<th><strong>Semester One – 2018</strong></th>
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<tbody>
<tr>
<td>Semester One begins</td>
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<tr>
<td>Easter break</td>
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<tr>
<td>Mid-semester break</td>
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<tr>
<td>ANZAC Day</td>
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<tr>
<td>Graduation</td>
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<tr>
<td>Lectures end</td>
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</tbody>
</table>
| Study break/exams | **Study Break:** Saturday 2 - Wednesday 6 June  
**Exams:** Thursday 7 - Monday 25 June |
| Queen’s Birthday | Monday 4 June |
| Semester One ends | Monday 25 June |
| Inter-semester break | Tuesday 26 June - Saturday 14 July |

<table>
<thead>
<tr>
<th><strong>Semester Two – 2018</strong></th>
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</thead>
<tbody>
<tr>
<td>Semester Two begins</td>
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<tr>
<td>Mid-semester break</td>
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<tr>
<td>Graduation</td>
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<tr>
<td>Labour Day</td>
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<tr>
<td>Lectures end</td>
</tr>
</tbody>
</table>
| Study break/exams | **Study Break:** Saturday 20 October - Wednesday 24 October  
**Exams:** Thursday 25 October - Monday 12 November |
| Semester Two ends | Monday 12 November |

<table>
<thead>
<tr>
<th><strong>Semester One – 2019</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester One begins</td>
</tr>
</tbody>
</table>
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