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What will be involved?

The main aim of the one-year Postgraduate 4th year BSc(Hons), 4th year BBiomedSc(Hons), PGDipSci and 1st year MSc [and for medical students the BMedSc(Hons)] is to introduce you to the realities and excitement of research. Working closely with your supervisor, you will plan, design and carry out a research project, which could lead to your first publication in a scientific journal. Clearly this is a major undertaking, and you should spend time during your third year finding out about the research interests of the academic staff, choosing a supervisor, and selecting a project – specific details are made available each year before the middle of second semester. You will find that staff are keen to talk to you about their research. If you need assistance in making a final decision, you are welcome to discuss it with me.

Why undertake 400-level Postgraduate studies? You will find that employers view favourably students who have completed an Honours degree or have gained a PGDipSci or Masters qualification. The extra experience which comes from designing, executing and communicating experimental work is a valuable asset for future employment. It also opens up opportunities for specialist teaching appointments, sales and management posts, or technical jobs in research establishments. Your future is limited only by your imagination, and we will do our best to stimulate that and help you on your way.

The next step could be an MSc or PhD degree. A 400-level research degree can launch you into higher research degree programmes of 1 or 3 years in length. In both the MSc and PhD degrees you will work closely with a supervisor to design and carry out a novel research project. The end-product is a MSc or PhD thesis, publications in scientific journals and usually participation in national or international conferences. During your PhD studies not only will you become a world authority in your own specialised field, but also an independent scientist capable of designing and performing research projects of the future. Such skills are much sought after both in the scientific and the commercial world either in New Zealand or overseas.

400-level Physiology is enjoyable and rewarding. Come and join us and start to become part of the academic and research community with all its international connections. Feel free to come and see me at any time if you need any help or advice.

Dr Martin Fronius, 400-level Coordinator

If interested in physiological research undertaking an MMedSc (medical students), the thesis year of an MSc or a 3-year PhD, please contact the Postgraduate Coordinator, Professor Brian Hyland.

Postgraduate Degree Options and Entry Requirements:

Bachelor of Sciences Honours (BSc (Hons)): A full-time 120-point degree made up of a research dissertation (PHSL 490, 60 points), a research topics paper (PHSL 474, 20 points) and two of three papers that look at specific areas of research in Physiology, PHSL 471, 472, 473 (20 points each).

Entry into Honours Physiology requires completion of five papers of 300-level (four in PHSL 300 and the fifth an approved 300-level paper usually in a related subject) achieving at least a B+ average in the four PHSL 300-level papers. Alongside these five 300-level papers it is strongly recommended that you take a further two papers and that they are at 200-level or above.

Postgraduate Diploma of Science (PGDipSci): A 120-point degree (that can be taken part-time) including a research project (PHSL 480, 40 points), a research topics paper (PHSL 474, 20 points) and three papers that look at specific areas of research in Physiology, PHSL 471, 472, 473 (20 points each).

Note: With HoD permission it is possible to take the PHSL 490 (60 points) research dissertation in place of PHSL 480, in which case the rest of the course is similar to the BSc Honours. The 60-point research dissertation is required if intending direct entry into a PhD.

Prerequisites: BSc including at least a B average (B+ average recommended) in four of PHSL 341, 342, 343, 344, 345 or equivalents.

Bachelor of Biomedical Sciences Honours (BBiomedSc (Hons)): A full-time 120-point programme, comprising a Research Thesis (research proposal, literature review, final thesis worth a total of 85% of the course) and Course Work worth 15% of the final mark.

Entry into Honours in Functional Human Biology is by invitation from the Dean of the School of Biomedical Sciences. Entry requires completion of the requirements for the degree of BBiomedSc with an average grade of at least B+ for the four prescribed 300-level papers. Students must have taken seven papers at 200-level or above during their 3rd year.

Masters of Science (MSc) (can be taken part-time)**:**

- 1st year: papers PHSL 471, 472, 473, 474 (20 points each) and Masters Thesis Preparation PHSL 495 (40 points).
- 2nd year: Research Thesis (12 months of full-time research).

*Prerequisite for **first year MSc**: BSc including at least a B average (B+ average recommended) in four of PHSL 341, 342, 343, 344, 345 or equivalents.*

Note: Instead of 1st year MSc we usually advise taking the PGDipSci course and then progressing to the 2nd year MSc thesis.

*Prerequisite for **second year MSc**: completion of first year MSc with a grade point average of B+. Alternatively, PGDipSci or BSc (Hons) students with a B+ grade average in 400-level Physiology can progress directly to second year MSc, i.e., to a thesis-only one-year MSc. A Masters thesis can commence at any time of the year and fees commence from the first of the month in which you start. Most students start at the beginning of the first semester. Note that thesis-only one-year MSc is a 12-month programme and the thesis can only be submitted in the 12th month.*

Bachelor of Medical Sciences Honours (BMedSc (Hons)): A full-time, one-year Research Thesis taken by medical students usually after the 3rd year of the MBChB degree has been completed.

Prerequisites: Have satisfactorily completed three or more years of the programme for the degrees of Bachelor of Medicine and Bachelor of Surgery or have alternative qualifications or experience acceptable to the Board of the Faculty of Medicine.

Note: After the BMedSc (Hons) year, students either return to the 4th year of the MBChB programme or convert the BMedSc (Hons) into the first year of a PhD and continue as a 2nd year PhD student in an intercalated MBChB/PhD programme. Students then return the following year to the 4th year of the MBChB programme and the equivalent of the 3rd year of a PhD is achieved during the summer vacation of 4th and 5th year and during the three-month elective period of the 6th year of the MBChB programme. For more information: http://www.otago.ac.nz/courses/qualifications/bmedschons.html

Masters of Medical Sciences (MMedSc) (can be taken part-time)**:** A one-year Research Thesis equivalent to the MSc that is available for medical graduates. It allows direct entry into the thesis year without the need for a prior year of 400-level papers. (However depending on the medical graduate's background, some 300- and/or 400-level papers may be required prior to acceptance into the MMedSc programme.)

Prerequisites: Have fulfilled one of the following conditions: (i) been admitted to the degree of Bachelor of Medical Science with Honours (or prior to 2001 the degree of Bachelor of Medical Science); (ii) been admitted to the degrees of Bachelor of Medicine and Bachelor of Surgery by a University in New Zealand or hold an equivalent medical qualification approved by the Board of the Faculty of Medicine; or (iii) have alternative qualifications or experience acceptable to the Board of the Faculty of Medicine.

Doctor of Philosophy (PhD): A PhD involves three years of supervised but independent research, writing and submitting a thesis embodying your results and publishing papers in scientific journals.

Prerequisites: a BSc (Hons) at the first to 2.1 level or a one-year 120-point MSc thesis (i.e., 2nd year MSc) or a PGDipSci (60-point thesis) with a B+ grade average. ***However higher grades are required to secure scholarships*** *– see page 20. A PhD can commence at any time of the year and fees commence from the first of the month in which you start. University policy relating to the PhD can be obtained from http://www.otago.ac.nz/graduate-research/study/index.html For application procedures for a PhD in Physiology, please consult http://phsl.otago.ac.nz/phd.php*

How to apply:

Before applying for a postgraduate degree you will need to identify the projects and supervisors that you are interested in (see Choosing a Supervisor below). The best way to do this is to read about the research projects offered by Physiology supervisors listed in this booklet and go to the Physiology website for additional information. Once you have identified some projects of interest, make a time to meet with potential supervisors to find out more and make your interest known.

Should you wish to pursue a 400-level degree within the Physiology Department, it is necessary that you engage with our internal selection process that matches potential students with 400-level projects. Once you have decided which projects you would like to be considered for (you can nominate three at the most) you need to fill in an application form with your ranked selections. This can be found on the Physiology website (http://phsl.otago.ac.nz/postgraduates.php). Please hand in your completed form to Tracey Fleet (Physiology Administration Office, Room G38 Lindo Ferguson Building) by **Friday 24 November 2017.** Late applications may be considered if there are projects still available, however, there is generally a waiting list for the more popular projects. See the flow diagram on our website which shows the timeline from application to entry into 400-level in Physiology. Because many students are applying for multiple degree programmes in 2018, some eligible students may be waitlisted or unmatched to projects until early 2018. Should you not be offered the project of your choice, you are welcome to check out projects that are still available within the Department by communicating with Tracey Fleet (tracey.fleet@otago.ac.nz).

Formal application for entry into 400-level BSc Honours or PGDipSci must be completed online via eVision as soon as possible. Once we confirm admission to the Administrator of the Division of Sciences, the decision will be available on eVision. Please make sure you apply as soon as possible.

Invitation into the BBiomedSc (Hons) programme comes from the Dean of the BMS once third year results are known. Acceptance into the programme is dependent on securing a supervisor.

BMedSc (Hons): Applications generally close at the beginning of August but please check with Mr Bruce Smith, Faculty Manager, medical.faculty@otago.ac.nz for the final date each year. Note that there are scholarships available for BMedSc (Hons) – see page 21 for details.

MMedSc: For information on the application process, contact Mr Bruce Smith, Faculty Manager, medical.faculty@otago.ac.nz

Choosing a Supervisor:

Staff, Postgraduate and Honours students in this Department are engaged in a wide variety of research. The lists below indicate our research strengths and what project areas are available. Look at the research poster displays in the Department and on the webpages of the Physiology Department and the School of Biomedical Sciences. These describe our research interests in more detail and provide lists of recent publications. For topics that interest you, read some of the publications, talk to the associated staff and discuss/develop possible project topics with potential supervisors, Visit their research laboratory, talk to their current postgraduate students. Don't rush into a decision on your project! If you want to discuss your options, make an appointment to see the 400-level convener, Dr Martin Fronius or the Postgraduate Coordinator, Prof Brian Hyland. If you have any general questions, contact our Departmental Administrator, Tracey Fleet, email: tracey.fleet@otago.ac.nz

Research Strengths:

Our research falls into the following main areas:

- **Cellular & Molecular Neuroscience:** Colin Brown, Rebecca Campbell, Ruth Empson, Allan Herbison, Phil Heyward, Brian Hyland, Karl Iremonger, Richard Piet, Phil Sheard and Alex Tups
- **Cardiovascular & Respiratory Physiology**: Pat Cragg, Jeff Erickson, Alison Heather, Pete Jones, Rajesh Katare, Regis Lamberts, Martin Fronius and Daryl Schwenke
- **Membrane & Ion Transport**: Andrew Bahn, Grant Butt, Martin Fronius, Ruth Empson, Kirk Hamilton, Pete Jones and Fiona McDonald

Research Projects

Supervisors and projects available for 2018.

Dr Andrew Bahn

Dysregulated signalling in pancreatic β-cells under hyperuricemic conditions - the cause for the onset of type 2 diabetes mellitus?

We have previously established that elevated plasma levels of uric acid (hyperuricemia), a metabolic product known to cause gout, contribute to impaired insulin secretion via increase of AMP-kinase (AMPK) expression and phosphorylation. Moreover, hyperuricemia leads to pancreatic β-cell death possibly mediated by AMPK and an elevated miR-34a expression. We are now interested in identifying the molecular links between hyperuricemia, insulin secretion and β-cell survival mediated by uric acid transporter GLUT9 to further decipher mechanisms responsible for the onset of type 2 diabetes.

Several projects are available, which will involve hyperuricemic and/or hyperglycaemic mouse models and cell model studies combining different animal, molecular biological, cell culture and hormone assay techniques. Students who are interested in the topic and are keen to meet a challenge to perform state of the art research on causes for the onset of type 2 diabetes mellitus are encouraged to apply.

Hyperuricemia and cancer - the cause for the onset, progression or aggressiveness of cancer?

We have previously established that elevated plasma levels of uric acid (hyperuricemia), a metabolic product known to cause gout, has a significant impact on prostate cancer cell proliferation and aggressiveness and the sensitivity to growth regulators such as activins involving the uric acid transporter GLUT9. We are now interested in identifying the molecular links between hyperuricemia and cancer especially prostate and breast cancer. Here we currently focus on p53 and its inactivation by ubiquitination regulating metabolism and redox homeostasis.

Several projects are available, which will involve cell model studies on prostate and breast cancer cells combining different molecular biological and cell culture techniques. Students who are interested in the topic and are keen to meet a

challenge to perform state of the art research on causes for the onset of cancer are encouraged to apply.

Drs Andrew Bahn & Martin Fronius

New concepts in blood pressure regulation: high sodium and fructose diet induced hypertension

Increased plasma concentrations of Na^+ and urate are associated with hypertension and cardiovascular disease. The effects of dietary increased sodium and urate levels (the latter caused by high fructose diet) on the vasculature are unknown. Accumulating evidence suggests that sodium as well as urate regulate gene expression in endothelial cells, which is associated with endothelial dysfunction. We are interested to identify the molecular mechanisms how sodium and urate alone or in a concerted action impairs endothelial function in order to cause cardiovascular disease. The project focuses on the role of urate transporters and ENaC as metabolic sensors of urate and Na^+ homeostasis and novel mediators of endothelial function.

The research will involve tissue analysis (vessels) from high salt diet and hyperuricemic mice and cell model studies (HUVEC cells) combining different animal, cell culture and molecular biological techniques as well as electrophysiology. Students who are interested in the topic and are keen to meet a challenge to perform state of the art research on an emerging and exciting new subject are encouraged to apply.

Drs Andrew Bahn & Regis Lamberts

The importance of magnesium for heart function and its regulation by hyperuricemia

Hyperuricemia is increasingly recognised as a contributor to cardiovascular disease, especially hypertension. It is also known that the application of blood pressure medication causes a loss of magnesium. Magnesium is a vital mineral that supports the function of ATP and consequently the metabolic/energy support of skeletal and heart muscles. We are now interested in the molecular regulation of the magnesium homeostasis in the heart under normal and hyperuricemic conditions.

Several projects are available, which will involve cell model and animal and/or tissue studies combining different molecular biological and cell culture techniques. Students who are interested in the topic and are keen to meet a challenge to perform state of the art research on the metabolic regulation of the heart via magnesium are encouraged to apply.

Associate Professor Grant Butt

Modulation of the intestinal epithelial barrier by commensal bacteria

The intestinal epithelium has a critical role in forming a physical barrier between the trillions of commensal bacteria in the intestinal lumen and the body. Defects in this barrier contribute to both intestinal diseases, such as Crohn's disease, and systemic diseases, such as arthritis and diabetes. An important aspect of the maintenance of the epithelial barrier is interaction between the commensal bacteria and the epithelium and, at present, this is the focus of the research in my laboratory. This project will use human colonic organoids, which are grown from adult intestinal stem cells, to investigate how bacterial products influence the development of the intestinal epithelium. In this project you will have the opportunity to investigate the signaling pathways utilized by bacteria to influence the proliferation and development of the colonic epithelium. It will involve the use of a range of techniques including cell culture, qPCR, western blotting and immunohistochemistry. Further details can be obtained by contacting Assoc. Prof Grant Butt.

Dr Rebecca Campbell

Dissecting the role of the brain in Polycystic Ovary Syndrome

Research in the Campbell lab is aimed at understanding the brain circuits that regulate fertility and the central defects that contribute to infertility. We are particularly focused on understanding how brain wiring and communication is altered in the common endocrine disorder Polycystic Ovary Syndrome (PCOS). Postgraduate projects are currently available to investigate the impact of androgen excess in the female brain on fertility, brain wiring and behaviour. Projects will involve working with transgenic mouse models, immunohistochemistry, light and confocal microscopy, and the application of imaging software and analysis.

Interested students can contact Dr Campbell by e-mail to discuss ideas in further detail.

Assoc Prof Pat Cragg

Not available for 2018.

Associate Professor Ruth Empson

Not available for 2018.

Dr Jeff Erickson

The role of oxidised CaMKII in apoptosis after myocardial infarction

CaMKII activation has emerged as a primary pathological event in oxidation-induced cardiac cell death, positioning CaMKII as a potential therapeutic target in the treatment of heart disease. With this in mind, our research focuses on investigating the role of oxidised CaMKII in cell death following myocardial infarction, particularly in the context of diabetes. Contributions by a talented 400 level student would be possible for a project examining apoptotic signaling in diabetic animal and human myocardium (with and without myocardial infarction) using protein blotting, histochemistry, and cell imaging techniques.

Dr Martin Fronius

ENaC in arteries

Blood pressure regulation depends on the ability of vessels to contract and dilate in response to shear stress that is caused by the blood flow when passing the surface of the endothelial cells. This response is impaired in cardiovascular disease.

ENaC emerges as a new candidate for regulating arterial function. The channel is of particular interest since its activity is regulated by shear stress.

The Fronius lab aims to understand how ENaC senses shear stress and how this mediates arterial function in health and disease.

Studies involve electrophysiology, site-directed mutagenesis, expression analyses (qPCR, western blots and immunofluorescence), pressure myography and microscopy techniques.

For any inquiry and/or more detailed information please contact me by e-mail (martin.fronius@otago.ac.nz).

Dr Kirk Hamilton

Not available for 2018.

Professor Alison Heather

Not available in 2018.

Professor Allan Herbison

Control of fertility by GnRH neurons

The gonadotropin-releasing hormone (GnRH) neurons control pituitary gland secretion to regulate fertility in all mammals including humans. Recent studies in our laboratory have identified that a specific group of kisspeptin neurons are critical in driving the pulsatile secretion of GnRH neuron that generates pulsatile gonadotropin secretion in the blood. The project will involve investigations into how this population of kisspeptin neurons manages to generate this pulsatile activity and how they are modulated by circulating levels of estradiol.

Professor Brian Hyland

Not available 2018.

Dr Karl Iremonger

Regulation of corticotropin-releasing hormone (CRH) neuron excitability

We are seeking students to join our laboratory within the Otago Centre for Neuroendocrinology (http://www.neuroendocrinology.otago.ac.nz/). Our laboratory focuses on understanding neural circuits which control stress. Corticotropin-releasing hormone (CRH) neurons are activated in response to stress and are responsible for controlling the levels of stress hormones in the body. Research projects in the lab focus on determining how the excitability of CRH neurons is controlled before, during and after stress. For more information, please contact Dr Karl Iremonger karl.iremonger@otago.ac.nz

Dr Pete Jones

Not available 2018.

Assoc Prof Rajesh Katare & Dr Martin Fronius

Identifying the novel intercellular transporter for microRNA

microRNAs (miRs) are gaining interest as the molecular regulators of cardiovascular disease. Interesting feature of miRs is their ability to release out of its host cells to produce effect on the neighbouring or remote cell in the heart. The transporter mediating the release of miR is not clear. This project aims to determine the role of gap junctional protein connexins acting as intercellular transporter of miRs. You will work with state of art high throughout automated systems for the expression and functional characterisation of cardiac connexin proteins in Xenopus oocytes. Focus of the project is to characterise the ability of connexins in releasing miRs and to identify the mechanisms that facilitate the release (e.g., membrane voltage, or membrane stretch). For more details to discuss about the project, contact either Martin Fronius (martin.fronius@otago.ac.nz) or Rajesh Katare (rajesh.katare@otago.ac.nz).

Assoc Prof Rajesh Katare & Dr Regis Lamberts

How to mimic diabetic conditions in heart cell culture

A common technique used by the researchers to mimic diabetic conditions in the heart is to culture in vitro cardiomyocytes with constant high glucose treatment. However, the level of glucose in a diabetic heart is not constantly high throughout the day, but fluctuates due to glucose-insulin interaction. This project therefore aims to establish a protocol to mimic the in vivo diabetic conditions in heart cell culture. For more details to discuss about the project, contact either Rajesh Katare (rajesh.katare@otago.ac.nz) or Regis Lamberts (regis.lamberts@otago.ac.nz).

Dr Regis Lamberts

Nerve innervation and dysfunction of the diabetic heart

Joint project with Assoc Prof Phil Sheard.

Autonomic dysfunction is one of the common and serious complications of diabetes, and is one of the important mechanisms that lead to impaired function of the diabetic heart. However how the innervation of the heart by the sympathetic and parasympathetic nervous systems has changed during diabetes is unknown. This project will aim to determine the nerve innervation of the diabetic heart, and relates this to the observed changes in cardiac dysfunction diabetes. Contact Dr Regis Lamberts (regis.lamberts@otago.ac.nz) or Assoc Prof Phil Sheard (phil.sheard@otago.ac.nz) for further information.

Associate Professor Fiona McDonald

Is retromer needed for ion channel trafficking and epithelial polarity?

To achieve the optimal balance of intracellular and extracellular ion concentrations the numbers of ion channels situated at the cell surface are tightly regulated. Retromer is a recently described intracellular complex that controls whether cell surface proteins are recycled to the cell surface or degraded. In this project you will contribute to understanding how the epithelial sodium channel (ENaC) is regulated by retromer, and whether the polar distribution of ENaC channels in epithelia is altered when retromer is disabled. The results will have implications for further understanding of electrolyte balance and blood pressure control.

Epithelial sodium channel and breast cancer

Breast cancer is the most common cancer affecting New Zealand women and, despite decades of international effort, how breast cancer progresses and metastasises is not well understood. Our new data shows the level of the epithelial sodium channel (ENaC) in patients' tumour cells correlates with breast cancer prognosis. We will test our hypothesis that changes in ENaC level promotes tumour generation by altering properties of breast cancer cells. Using characterised breast cancer cell lines you will increase or decrease ENaC expression levels and quantify changes in breast cancer cell proliferation and migration rates.

Dr Richard Piet

Circadian regulation of a neuronal circuit governing fertility

We are seeking motivated students to undertake research on the circadian regulation of neuronal circuits governing fertility.

In female rodents, the circadian clock located in the suprachiasmatic nucleus (SCN) of the hypothalamus plays a key role in timing the generation of the pre-ovulatory surge of GnRH release. This is thought to be achieved through projections from SCN neurons to kisspeptin neurons, a population of hypothalamic neurons that drive the activity of GnRH neurons. Our team, which is part of the Centre for Neuroendocrinology, aims to better understand the anatomy and function of this circuit in physiological and in pathological conditions.

Specific projects may include neural pathway tract-tracing, immunohistochemistry or slice patch-clamp electrophysiology.

Dr Daryl Schwenke

Not available in 2018.

Associate Professor Phil Sheard

Our primary research focus in on investigation of age-related degenerative changes in the brain, spinal cord, and in skeletal muscles. We mainly use immunohistochemistry to examine tissues removed from normal young and elderly mice, and we investigate the nature of any benefits that derive from the use of exercise as an intervention to slow the rate of neuromuscular ageing. Specific 400-level projects are designed and configured in a collaborative process with the student.

Nerve innervation and dysfunction of the diabetic heart

Joint project with Dr Regis Lamberts.

Autonomic dysfunction is one of the common and serious complications of diabetes, and is one of the important mechanisms that lead to impaired function of the diabetic heart. However how the innervation of the heart by the sympathetic and parasympathetic nervous systems has changed during diabetes is unknown. This project will aim to determine the nerve innervation of the diabetic heart, and relates this to the observed changes in cardiac dysfunction diabetes. Contact Dr Regis Lamberts (regis.lamberts@otago.ac.nz) or Assoc Prof Phil Sheard (phil.sheard@otago.ac.nz) for further information.

Dr Alex Tups

The role of brain inflammation in obesity, diabetes and circadian rhythms

We are seeking a 400-level student to join a multidisciplinary research group at the Centre of Neuroendocrinology.

Our group is studying the neuroendocrine regulation of body weight and glucose homeostasis and the link between the circadian clock and metabolism. We are particularly interested in the role of brain inflammation as predisposing factor for the development of obesity and diabetes. Various projects are available that focus on different aspects of brain inflammation, obesity, diabetes and circadian rhythm disorders.

Our research combines molecular biological and neuroanatomical techniques with metabolic phenotyping and behavioural analyses.

Paper Descriptions:

PHSL 471 Systematic Physiology

PHSL 472 Neurophysiology

PHSL 473 Cellular Physiology

These three 20-point papers are taught in series (probably in the sequence PHSL 472, 473 and 471) and each consists of an eight-week seminar series exploring research frontiers in physiology. In these papers you will come to appreciate the way in which hypotheses are developed and substantiated and how to abstract information and present it. Each paper requires preparation and participation in class and is examined one week after the end of its seminar series, prior to the start of the next paper.

PHSL 474: Research Topics

This 20-point paper is a self-directed literature survey in areas of physiology that form the background to work undertaken in the research project. It is specifically designed for each student, guided by the supervisor and is internally assessed by three essays.

PHSL 490: Research Dissertation (Hons)

This is a 60-point supervised laboratory project involving original research leading to the production of a dissertation in the format of a thesis. All steps of the project are guided by the supervisor. Specific projects offered by available supervisors are listed above. PHSL 490 also involves ~15-min oral presentations to the Department in April and September/October. Thesis submission is in late October.

PHSL 480: Research Project (PGDipSci)

This is a 40-point supervised laboratory project involving original research and leading to the production of a research report in the format of a thesis. All steps of the project are guided by the supervisor. A ~15-min oral presentation on the project to the Department is required in April and in September/October. Deadline for thesis submission is late October.

PHSL 495: Masters Thesis Preparation (first year MSc)

This is a 40-point research project for MSc students guided by the supervisor. It involves submission of a preliminary proposal by the end of Semester One, and a formal written research proposal (literature review, bibliography, aims and objectives, methodology, and results and interpretation of the pilot study) to show the full project is feasible by late October. It also involves collaboration with the supervisor in applying for ethical approval for the project and, towards the end of second semester, a ~15-min oral presentation to the Department outlining the project.

Note: In the Department of Physiology you are advised to take the PGDipSci (instead of the 1st year MSc) and then progress to the 2nd year of an MSc.

BMED 4BF: BBiomedSc Thesis in Functional Human Biology (4th year)

This paper code encompasses a 120-point programme where you are engaged in full-time research (Research Thesis) worth 85% of the course and Course Work worth 15%. The Research Thesis comprises an initial research proposal (April), a literature review (June) and a final thesis (November). All steps of the research are guided by the supervisor. A ~15-min oral presentation to the School of Biomedical Sciences on the research proposal in early April and on the research outcomes in early October are also required. Deadline for thesis submission is Late October.

PHSL 4F*: BMedSc (Hons)*

The degree is for MBChB students and involves a full-time year of research in a field of medical science (requiring the production of a thesis).

PHSL 5: Master's Thesis (second year MSc)

For this you are engaged in full-time research for 12 months, or part-time research for 24 months, culminating in the production of a thesis and an oral presentation to the Department. Information on University policy relating to the MSc thesis can be obtained at http://www.otago.ac.nz/study/masters

Note: Scholarships are available for this thesis year – see p. 20 for further details.

MICN 8F: Medicine MMedSc

The degree is for MBChB students or MBChB graduates and involves a year of full-time research, or part-time research for 24 months, in any field of medical science, often a clinical discipline, at Masters level (requiring the production of a thesis).

Postgraduate Scholarships and Stipends:

University Scholarships for Master Thesis/PhD

Masters thesis and PhD students can apply for University Scholarships at any time throughout the year as part of their admission process. However, all prospective students must apply to the Department first for admission into each programme (see our website for application process).

Masters: $13,000 for 12 months + payment of domestic tuition fees. Up to 60 scholarships are available per year to support domestic Master's students. Up to 4 scholarships are available per year to support international Master's students ($13,000 for 12 months + payment of international tuition fees).

PhD: $25,000 pa + payment of fees for 3 years. These are available to both domestic and international students.

Scholarships also cover the costs incurred in the production of four hard-bound copies of the completed thesis. Scholarships **exclude** student services fee and insurance.

For further details including application forms for these scholarships, please refer to the Otago University website at: http://www.otago.ac.nz/graduate-research/scholarships/

Departmental Masters Scholarship for Thesis Year

The Department offers one MSc Scholarship per year which comprises $13,000 for 12 months + domestic fees + costs incurred in the production of four hard-bound copies of the MSc thesis. Applications will be considered in January each year.

Scholarships from Research Grants

Some PhD and Masters thesis scholarships can be funded from research grants but these are rare and usually require earlier deadlines for applications.

BMedSc (Hons) Scholarships

There are various scholarships available to New Zealand citizens/permanent residents only. See the Faculty of Medicine website for details to see which scholarships you are eligible to apply for - http://micn.otago.ac.nz/current-students/scholarships/bmedsc-hons. The closing date for applications is 1 October in the year previous to commencement of study for BMedSc (Hons).

400-level Scholarships and Stipends for Honours, PGDipSci or 1st year Masters

Neither the University nor the Department offer these for 400-level students. However, BBiomedSc and Māori / Pasifika students who gain high grades in their 300-level studies can be awarded a University of Otago Scholarship for 400-level studies, which translates into a small monetary award if they undertake 400-level studies the following year. See www.otago.ac.nz/bms/postgraduate/index.html.

Supplementary income from demonstrating

There are opportunities for all Masters thesis and PhD students to earn supplementary income as a demonstrator (hourly rate currently, $15.75/hr to $29.38/hr depending on experience + 8% holiday pay). A similar opportunity exists for 400-level students but as a 400-level course is only nine months, be cautious about the time commitment to demonstrating. The time commitment to demonstrating must be discussed with the supervisor.

Careers for Physiology Postgraduates:

With an Honours, PGDipSci or MSc degree in Physiology, or a BBiomedSc(Hons) in Functional Human Biology, the groundwork is laid for a wide variety of successful careers. Some, such as academic and research positions, take direct advantage of the specialist knowledge and technical research skills you have gained during your Physiology course. However, your scientific training will also have developed many more generic intellectual skills, for example obtaining, interpreting and retaining of information, time management and so on. These skills will last a lifetime and will place you well in many competitive job-seeking situations in areas outside the direct focus of your undergraduate degree. A degree in Physiology thus not only opens up careers in the biological and health sciences, but also a wide range of other appealing and absorbing jobs in which a high-level tertiary qualification in science is advantageous.

Physiology graduates with Honours, PGDipSci and MSc degrees and Functional Human Biologists with an Honours degree in BBiomedSc thus succeed in a wide range of environments, including:

- research assistants and technologists in medical and paramedical laboratories, hospitals, Crown Research Institutes, Universities, and the pharmaceutical and agricultural industries;
- lecturers and teachers in universities, polytechnic institutes, and secondary schools;
- allied health professions such as optometrists, audiologists, clinical perfusionists, clinical physiologists and technicians (renal dialysis, respiratory, cardiac, sleep);
- aviation and space industries;
- researchers and directors in the film and television industries;
- representatives of pharmaceutical firms and scientific equipment suppliers;
- sports institutes and academies;
- medical doctors, dentists, pharmacists, physiotherapists, and patent attorneys;
- business administrators and managers, often (but not always) in enterprises with scientific, biological or health science linkages.

If you have more questions about particular types of employment we can often put you in touch with a Physiology graduate with experience in the field in which you are interested.

For those captivated by the excitement of research and the opportunity of being at the frontiers of knowledge, studying for a PhD is your next career step – particularly if your goal is an academic career. A PhD involves three years of supervised but independent research, writing and submitting a thesis embodying your results and publishing papers in scientific journals. Following the award of your PhD, you will almost certainly need to demonstrate your ability for fully independent research by spending two or three years in Post-Doctoral Fellowships, probably in the United States or Europe. Fortunately Otago graduates have an excellent reputation and are keenly sought. Finally will come the search for a more permanent position. The prospects for employment opportunities for academic scientists are good, and are likely to be further strengthened as New Zealand joins the global move towards a knowledge-based economy, in which science will play a central role.

For further information on studying in the Department, or on entry requirements, careers and PhD and Masters thesis scholarships, you are advised to contact:

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