Pharmacology involves the study of the actions of drugs and chemicals on cells, tissues and the whole body. It includes finding out how drugs produce beneficial and adverse effects, with the aim of improving the way drugs are tested and to give greater benefit in the treatment of disease. The cellular and chemical abnormalities of disease states are studied in the expectation that molecules may be designed specifically to correct the abnormality. The study of pharmacology requires understanding normal body functions (biochemistry and physiology) and the disturbances that occur (pathology). Pharmacology is the basis of much of the research and development of new drugs. The future of pharmacology is assured, as there remain many diseases for which neither cure nor palliation have been devised - for example, Alzheimer’s disease, neurogenerative diseases, many forms of cancer. Even when a cure or treatment is available, few medicines are perfect and the search for better drugs continues. In addition, other scientists such as physiologists, biochemists and psychologists often find a knowledge of pharmacology useful as they use drugs to probe and define the biological systems they are studying.

Toxicology is closely related to pharmacology but specialises in the study of the harmful effects of drugs and other chemicals on biological systems. A toxicologist is trained to examine the nature of these effects, including their cellular, biochemical and molecular mechanisms of action; and to assess the potential effects on human health and environmental significance of various types of chemical exposures. The variety of potential adverse effects and the diversity of chemicals in the environment make toxicology a very broad science.

In brief, pharmacologists and toxicologists aim to develop a better understanding of the actions of drugs and chemicals on biological systems for the improvement of human and animal health.

What are Pharmacology and Toxicology?
The Department of Pharmacology and Clinical Pharmacology was established in 1978 and is situated in the Faculty of Medical and Health Sciences, at the University of Auckland's Grafton Campus.

It is one of the 5 Departments in the School of Medical Sciences. It is involved in the teaching of pharmacology and toxicology to medical, pharmacy and science students, and has many active research programmes in recently renovated modern laboratories in diverse areas of biomedical research.

Sources of support from outside the University include the:
- Health Research Council
- Cancer Society of New Zealand
- NZ Neurological Foundation
- National Heart Foundation
- National Child Health Research Foundation
- Lotteries Health Board
- Auckland Medical Research Foundation
- The Wellcome Trust
- The Marsden Fund
- FRST
- Maurice and Phyllis Paykel Trust

**Physical location**
Faculty of Medical and Health Sciences
The University of Auckland, Grafton Campus
85 Park Road
Grafton Auckland

**Postal address**
Department of Pharmacology and Clinical Pharmacology
The University of Auckland
Private Bag 92019
Auckland 1142 New Zealand
Phone: +64 9 923 6733
Website: www.fmhs.auckland.ac.nz/sms/pharmacology

**Head of Department and Associate Professor in Pharmacology**
Michelle Glass
PhD Auckland
Phone: +64 9 923 6247
Room: 503-501F
Email: m.glass@auckland.ac.nz

**Professor in Pharmacology**
Michael Dragunow
PhD Otago
Phone: +64 9 923 6403
Room: 503-501G
Email: m.dragunow@auckland.ac.nz

**Professor in Clinical Pharmacology**
Nicholas Holford
MSc MBChB Manc, MRCP(UK), FRACP
Phone: +64 9 923 6730
Room: 503-302A
Email: n.holford@auckland.ac.nz

**Professor in Clinical Pharmacology**
Mark McKeage
MBChB Otago MMedSci, PhD London FRACP
Phone: +64 9 923 7322
Room: 504-236A
Email: m.mckeage@auckland.ac.nz

**Associate Professor in Pharmacology**
James Paxton
PhD Glasgow
Phone: +64 9 923 6413
Room: 503-302J
Email: j.paxton@auckland.ac.nz
Associate Professor in Pharmacology
Bronwen Connor
PhD Auckland
Phone: +64 9 923 3037
Room: 501-501D
Email: b.connor@auckland.ac.nz

Associate Professor in Toxicology
Malcolm Tingle
PhD Liverpool
Phone: +64 9 923 4949
Room: 503-302H
Email: m.tingle@auckland.ac.nz

Associate Professor in Pharmacology
Debbie Young
PhD Auckland
Phone: +64 9 923 4491
Room: 502-501C
Email: ds.young@auckland.ac.nz

Senior Lecturer in Clinical Pharmacology
Susannah O’Sullivan
PhD, FRACP
Phone: +64 9 923 6138
Room: 502-210T
Email: s.osullivan@auckland.ac.nz

Senior Research Fellow
Scott Graham
PhD Aberdeen
Phone: +64 9 923 6947
Room: 503-501B
Email: s.graham@auckland.ac.nz

Senior Research Fellow
Jian Guan
PhD Auckland, MD China
Phone: +64-09-9236134
Room: 503-263A
Email: j.guan@auckland.ac.nz

Senior pharmacology tutors
and professional teaching fellows

Liam Anderson
BTech, PGDip Forensic
Phone: +64 9 923 6037
Room: 501-002
Email: l.anderson@auckland.ac.nz

Deanna Bell
PhD Auckland
Phone: +64 9 923 6950
Room: 501-002
Email: d.bell@auckland.ac.nz

Rachel Cameron
PhD Auckland
Phone: +64 9 923 3186
Room: 501-002
Email: r.cameron@auckland.ac.nz

Leslie Schwarcz
PhD Eugene
Phone: +64 9 923 6950
Room: 501-002
Email: l.schwarcz@auckland.ac.nz
Teaching technicians

Adina Giurgiu  
MSc Romania  
Phone: +64 9 923 5058  
Room: 502-361  
Email: a.giurgiu@auckland.ac.nz

Gabriella Blidarean  
MSc Romania  
Phone: +64 9 923 5058  
Room: 502-361  
Email: g.blidarean@auckland.ac.nz

Administrative Staff

Kavita Hussein  
Group Services Coordinator  
Phone: +64 9 923 6733  
Room: 505-1D06  
Email: k.hussein@auckland.ac.nz

Honorary appointments

Professor Lynn Ferguson (Nutrition)  
Prof Alan Merry (Anaesthesiology)  
Dr Glen Reid (University of Sydney)  
Mr Trevor Speight (Medicines Information Company)  
Dr Guy Warman (Anaesthesiology)  
Professor Bill Wilson (ACSRC)  
Dr David Woolner (DocRx)

Research fellows

Erin Cawston PhD Otago  
Natasha Grimsey PhD Auckland  
Kathryn Jones PhD Auckland  
Alexandre Mouravlev PhD Novosibirsk  
Pritika Narayan PhD Auckland

Research technicians

Miranda Aalderink MSc Massey  
Sheryl Feng MSc Auckland  
Erin Firmin MSc Auckland  
Dahna Fong PhD Auckland  
Prashannata Khwaounjoo MSc Auckland  
Christa MacDonald BSc (Hons) Auckland  
Rebecca Marnane MSc Auckland

Areas of research interest

Anticancer drugs

Prof McKeage, Assoc Profs Paxton and Tingle, and Prof Wilson

Cancer is the most common cause of death between the ages of 30 to 60. Chemotherapy has emerged as a form of cancer treatment which, although it may have very disagreeable side effects, has dramatically improved survival for some cancers, particularly in children. More effective and less toxic drugs are required. New drugs have been developed locally in the Auckland Cancer Society Research Centre and collaborative research is under way into their fate (i.e. absorption, distribution, metabolism and elimination) in various animal models and in human subjects; the construction of concentration-effect models; tumour-targeted drug delivery and action; mechanisms of toxicity, and the extrapolation of these results to patients for more effective therapy and fewer adverse drug reactions.

Cancer clinical pharmacology

Prof McKeage

We are a research group of eight staff and students working on translational and clinical projects concerned with the clinical pharmacology and development of anticancer drugs. Our group mission is to reduce suffering and mortality from cancer by generating pharmacological knowledge about new and existing anticancer drugs for ultimate use in their clinical applications.

Current research projects are exploring novel DMXAA-based drug combinations, chemotherapy-induced peripheral neuropathy and novel anticancer drugs in phase I trials.

Neural reprogramming and repair

Assoc Prof Connor

The laboratory of Neural Reprogramming and Repair focuses predominantly on developing new medicines and therapeutic strategies to treat disorders of the brain that involve brain cell death such as Parkinson’s disease, Huntington’s disease, head injury, and stroke. Research is being undertaken to develop novel treatment strategies to prevent cell death, replace lost brain cells and reduce clinical symptoms of neurological disease and brain injury using techniques such as gene delivery and stem cell therapy. In particular, we use cell reprogramming technology to generate brain stem cells from patient-derived skin cells to model neurological diseases. This technology is used to study disease pathology in living human brain cells as well as identify and screen new drug targets.
Neural reprogramming and repair

Assoc Prof Connor

The laboratory of Neural Reprogramming and Repair focuses predominantly on developing new medicines and therapeutic strategies to treat disorders of the brain that involve brain cell death such as Parkinson’s disease, Huntington’s disease, head injury, and stroke. Research is being undertaken to develop novel treatment strategies to prevent cell death, replace lost brain cells and reduce clinical symptoms of neurological disease and brain injury using techniques such as gene delivery and stem cell therapy. In particular, we use cell reprogramming technology to generate brain stem cells from patient-derived skin cells to model neurological diseases. This technology is used to study disease pathology in living human brain cells as well as identify and screen new drug targets.

Paediatric pharmacology

Prof Holford

Prof Holford works with Prof Anderson at Starship Hospital on the clinical pharmacology of medicines in babies and children. The focus of the work is to understand how the changing size and maturation of organ function can be used to predict pharmacokinetic and pharmacodynamic properties of medicines. This is then used to create practical dosing guidelines for babies ranging from very premature to full term and then for infants and children. Some data is collected at Starship Hospital but most of the analysis relies on collaboration with paediatricians overseas.

Disease progress and drug action

Prof Holford

Clinical pharmacology expresses the combined knowledge of disease and how drugs affect it. Attention is turning towards understanding how drugs affect the long-term progression of disease. Dr Holford is engaged in studies of Parkinson’s Disease and Alzheimer’s Disease, osteoporosis, depression and HIV/AIDS which describe both the effects of drugs and the natural progression of the disease over time.

Bioavailability, metabolism and transport of phytochemicals

Assoc Prof Paxton

It is now accepted that a high intake of phytochemicals from a diet rich in fruit and vegetables results in a reduced risk of cancer, cardiovascular disease, osteoporosis and other age-related degenerative illnesses. Most research on these dietary “phyto-pharmaceuticals” has focussed on their mechanisms of action, but to be effective, these bioactive food ingredients must cross the gut epithelium, gain access to the bloodstream, and reach their target site of action in the hepatocytes, or tumour cells, or other organs in the body. A better understanding of these interactions with the uptake and efflux systems and drug metabolizing enzymes in the body will allow strategies to improve the beneficial effects of these bioactive food ingredients to prevent cancer and ageing diseases by diet supplementation tailored to the individual. In addition, these studies will allow the identification of possible detrimental drug-phytochemical interactions. It is also highly likely that these studies will lead to the identification of diet-derived compounds for development as a clinical agent to reverse multidrug resistance, one of the major factors responsible for the failure of cancer chemotherapy.

Drug metabolism and toxicology

Assoc Prof Tingle

Nearly every drug undergoes some sort of metabolism in the body. This is important for duration of drug action plus the toxicity of drugs often involves metabolism, either through a lack of metabolism resulting in higher than expected concentrations or conversion to a chemically-reactive metabolite. Such reactive intermediates may interact with critical macromolecules to initiate direct toxicity (cell death), genotoxicity or hypersensitivity reactions. There may be considerable variability in metabolism between humans and across species, in particular the expression and activity of metabolizing enzymes that may in turn influence the toxicity of drugs and environmental toxicants. Research is focussed on investigating drug metabolism in humans (patients or volunteers) and modelling such metabolism using in vitro and in vivo approaches to probe the role this may play in drug toxicity.

Human neurodegeneration research

Prof Dragunow

Professor Mike Dragunow is a Molecular Pharmacologist and Neuroscientist. Research in his group focuses on molecular mechanisms of human brain neurodegeneration and repair and on developing novel treatments for brain diseases using adult human brain material, tissue microarray, cell culture models (cell lines and primary adult human brain cell cultures), molecular pharmacology and high-content analysis. These combined research tools are being used to understand the causes of human neurodegeneration and to test and develop new treatment strategies.

Receptor signalling lab

Assoc Prof Glass

The Laboratory of Receptor Signalling focuses predominantly on the signalling interactions of G-protein coupled receptors, and their potential role in neurodegenerative disease. We have a particular interest in cannabinoid receptors, their signalling interactions with other GPCRs and their contribution to neuroprotection or neurodegeneration in diseases such as Huntington’s disease. Our work focuses on using cell models to understand receptor signalling and cross talk, as well as utilizing cells to model disease processes such as those that occur in Huntington’s disease. We correlate information gained in this way with the pathology seen in the human brain, through collaborations with the Neurological Foundation Human Brain bank, and other researchers.

New therapies for brain diseases

Assoc Prof Young

This group is interested in understanding disease mechanisms and developing novel therapeutic strategies for neurodegenerative disorders such as Alzheimer’s, Parkinson’s and Huntington’s disease, stroke and epilepsy. Key research areas in the lab include gene therapy and vaccine/ antibody-based therapeutic approaches, understanding how environment affects brain structure and function, developing neurodegenerative disease models and optimising viral vector-mediated gene transfer.
technology. The research covers the full spectrum from molecular biology through to animal behaviour, with the aim being to advance promising approaches to human clinical trials.

**Neuro-Immune Interactions Research**

Dr Graham

My group is focused on investigating the interactions between the immune system and brain cells (neuroinflammation). I have a long-standing interest in the cannabinoid system, where it is thought that the CB2 receptor has therapeutic value for neuroinflammation (mostly rodent based observations). Neuroinflammation underlies most neurological conditions, being a severe driving force in diseases such as MS (relapsing and remitting) and stroke. The blood-brain-barrier (BBB) represents the interface between these systems. It is a selective barrier and protects the CNS from pathogens and undesirable entry of immune cells. Protection of the BBB is a growing area of clinical investigation as it represents a tissue that can be targeting with conventional drugs.

**Mechanisms and Treatment of Bone Disease**

Dr O'Sullivan

Dr Susannah O'Sullivan is a member of the Bone and Joint Research Group, which conducts clinical and laboratory research into the mechanisms of bone and joint disease, and the treatment of conditions such as osteoporosis, Paget's disease, and gout. Many medicines used for the treatment of non-bone conditions have effects on bone, including glucocorticoids, thiazolidinediones, and cancer treatments. Dr O'Sullivan is involved in laboratory and clinical research determining the bone effects of tyrosine kinase inhibitors, and the clinical effects of glucocorticoids in patients undergoing heart and lung transplant. Her other major research interest is the treatment of bone loss in premenopausal women. Current pharmacologic treatments are ineffective, unappealing in women of reproductive age or expensive, and this research focuses on investigating for an affordable and safe therapy for managing premenopausal women with bone loss.

**Nutritional Neurosciences**

Dr Guan

Dr Guan is a neuroscientist and her research interests include nutritional and environmental effects on brain development and functions, as well as the role for small vessel degeneration in neurological conditions by evaluating neuropasticity, vascular remodelling and the interactions of neurons, glial phenotypes and capillaries. Her research specialty includes neurobiology and neuro-pharmacology of IGF-1 and its related peptides, animal modelling of neurological conditions, behavioural evaluations, biological and pathological assessments of brains. The discovery of the mechanism of IGF-1 metabolites leads to the investigation of novel biomarker for deficiency of IGF-1 function. The group is working toward the potential connections between neurodegeneration and metabolic disorders.

**Course and Programmes**

**BSc (Majoring in Pharmacology)**

A BSc requires at least 360 points with 300 chosen from a minimum of 3 subjects listed in the BSc schedule. At least 180 points must be above stage I. At least 75 points must be obtained from stage II courses. For a single or first major in pharmacology, you must obtain at least 60 points from courses MEDSCI 303 – MEDSCI 307. A second major must include 45 points from MEDSCI 303-307.

In addition, a student must pass 30 points from courses offered in the General Education Schedule approved for this degree.

Up to 30 points may be taken from courses available for other programmes offered at this University.

A typical course of study to obtain a BSc majoring in Pharmacology might be as follows: (Note that 120 points per year is the normal load for full time study).

**Stage I**

MEDSCI 1422 Biology for Biomedical Science: Organ Systems  
BIOSCI 1012 Essential Biology: From Genomes to Organisms  
BIOSCI 1062 Foundations of Biochemistry  
BIOSCI 1072 Biology for Biomedical Science: Cellular Processes & Development  
CHEM 1101 Chemistry of the Living World  
CHEM 1201 Chemistry of the Material World or  
STATS 1071 Statistics for Science and Technology or  
COMPSCI 1111 Mastering Cyberspace or  
PHYSICS 1601 Physics for the Life Sciences or General Education Courses

1 Prerequisites for BIOSCI 203  
2 Prerequisites for MEDSCI 203, MEDSCI 205 and 206

Please note that the prerequisites have changed from previous years and apply to all students beginning their degree from 2016. For students who commenced their studies prior to 2016 the prerequisites for stage III pharmacology courses are MEDSCI 204 and one of the following: MEDSCI 205, MEDSCI 206 or BIOSCI 203.
Stage II

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Pts</th>
<th>Course director</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDSCI 204 SH</td>
<td>Pharmacology and Toxicology</td>
<td>15</td>
<td>D. Young</td>
<td>BIOSCI 106, CHEM 110, MEDSCI 142, BIOSCI 101 is required for MEDSCI 304 and BIOSCI 107 is required for MEDSCI 305, 306 &amp; 307</td>
</tr>
</tbody>
</table>

Additional Stage II courses to MEDSCI 204 might include (be aware some of these may be core courses for Stage III Pharmacology courses, see table below):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDSCI 203</td>
<td>Mechanisms of Disease</td>
<td></td>
</tr>
<tr>
<td>MEDSCI 205</td>
<td>The Physiology of Human Organ Systems</td>
<td></td>
</tr>
<tr>
<td>MEDSCI 206</td>
<td>Introduction to Neuroscience</td>
<td></td>
</tr>
<tr>
<td>CHEM 240</td>
<td>Measurement Analysis in Chemistry and Health Sciences</td>
<td></td>
</tr>
<tr>
<td>BIOSCI 201</td>
<td>Cellular and Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>BIOSCI 202</td>
<td>Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOSCI 203</td>
<td>Biochemistry</td>
<td></td>
</tr>
<tr>
<td>MEDSCI 202</td>
<td>Microbiology and Immunology</td>
<td></td>
</tr>
</tbody>
</table>

General Education Courses

Stage III

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Pts</th>
<th>Course director</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDSCI 303 FH</td>
<td>Drug Disposition and Kinetics</td>
<td>15</td>
<td>J. Paxton</td>
<td>MEDSCI 204</td>
</tr>
<tr>
<td>MEDSCI 304 FH</td>
<td>Molecular Pharmacology</td>
<td>15</td>
<td>M. Glass</td>
<td>MEDSCI 204, BIOSCI 203</td>
</tr>
<tr>
<td>MEDSCI 305 SH</td>
<td>Systems Pharmacology</td>
<td>15</td>
<td>B. Connor</td>
<td>MEDSCI 204 and 30 points from BIOSCI 203, MEDSCI 203 &amp; MEDSCI 205</td>
</tr>
<tr>
<td>MEDSCI 306 SH</td>
<td>Principles of Toxicology</td>
<td>15</td>
<td>M. Tingle</td>
<td>MEDSCI 204 and 30 points from BIOSCI 203, MEDSCI 203 &amp; MEDSCI 205</td>
</tr>
<tr>
<td>MEDSCI 307 FH</td>
<td>Neuropharmacology</td>
<td>15</td>
<td>M. Dragunow</td>
<td>MEDSCI 204, MEDSCI 206</td>
</tr>
</tbody>
</table>

GPA requirements may be in place. Contact the Course Director for further information.

Students with GPAs lower than stated will be waitlisted. Additional Stage III courses might include:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOSCI 350</td>
<td>Protein Structure and Function</td>
<td></td>
</tr>
<tr>
<td>BIOSCI 351</td>
<td>Molecular Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOSCI 353</td>
<td>Molecular and Cellular Regulations</td>
<td></td>
</tr>
<tr>
<td>BIOSCI 356</td>
<td>Developmental Biology and Cancer</td>
<td></td>
</tr>
<tr>
<td>MEDSCI 301</td>
<td>Molecular Basis of Disease</td>
<td></td>
</tr>
<tr>
<td>MEDSCI 309, 311, 312, 316 or 317</td>
<td>(Physiology papers)</td>
<td></td>
</tr>
</tbody>
</table>

BSc (Hons), PGDipSci, PGDipHSci, MSc or PhD

Students who have completed a BSc in Pharmacology, are able, subject to appropriate grades, to advance to either the one year BSc (Hons) or one year PGDipSci or PGDipHSci programme. The prerequisites are at least 60 points in stage III pharmacology with a recommended minimum average grade of B+ for BSc (Hons) and B for PGdip. BSc (Hons) students undertake courses (75 points) and a dissertation (45 points). The courses are usually chosen from the 700 level courses listed below. BSc (Hons) is a fast track to PhD. Students with an average grade B- in the PGDipSci or PGDipHSci may proceed to a one year MSc or MHSc by research thesis only (120 points) conditional upon finding a supervisor. Students with good marks in either the BSc (Hons) or MSc programme are able to proceed to a further three years research for a PhD.

BSc (Hons)

Prerequisites: A BSc degree with at least 60 points in pharmacology from MEDSCI 303-307 and at least 90 points at Stage III and a minimum recommended grade of B+.

Requirements: BSc (Hons) Dissertation PHARMCOL 788 (45 points) plus 75 points from MEDSCI 701-702, MEDSCI 715-723.

MSc

Prerequisites: PGDipSci (in Pharmacology) with an average grade B-, or BSc (Hons).

Requirements: MSc Thesis PHARMCOL 796 (120 points).

PGDipSci

Prerequisites: A BSc including at least 45 points from MEDSCI 303-307 and a minimum recommended grade of B.

Requirements: 120 points at 700 level with at least 60 points from MEDSCI 701 or 702, MEDSCI 715-723.
Stage IV
(Enrolment to all 700 level courses requires permission of the HOD).
Not all 700 level courses will be taught every year and you must check their availability with the Department.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Pts</th>
<th>Course director</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDSCI 701 FH/SH</td>
<td>Special Studies in Medical Science</td>
<td>15</td>
<td>R. Booth</td>
</tr>
<tr>
<td>MEDSCI 715 FH</td>
<td>Molecular Toxicology</td>
<td>15</td>
<td>M. Tingle</td>
</tr>
<tr>
<td>MEDSCI 716 FH</td>
<td>Advanced Drug Disposition and Kinetics</td>
<td>15</td>
<td>J. Paxton</td>
</tr>
<tr>
<td>MEDSCI 717 FH</td>
<td>Advanced Neuroscience: Pharmacology</td>
<td>15</td>
<td>B. Connor/M. Glass</td>
</tr>
<tr>
<td>MEDSCI 718 FH</td>
<td>Pharmacology of Anaesthetics/Analgesics</td>
<td>15</td>
<td>G. Warman/J. Cheesman</td>
</tr>
<tr>
<td>MEDSCI 719 SH</td>
<td>Pharmacometrics</td>
<td>15</td>
<td>N. Holford</td>
</tr>
<tr>
<td>MEDSCI 720 FH</td>
<td>Biomedical Research Techniques</td>
<td>15</td>
<td>D. Young</td>
</tr>
<tr>
<td>MEDSCI 721 SH</td>
<td>Advanced Toxicology</td>
<td>15</td>
<td>M. Tingle</td>
</tr>
<tr>
<td>MEDSCI 722 SH</td>
<td>Clinical Pharmacology</td>
<td>15</td>
<td>N. Holford</td>
</tr>
<tr>
<td>MEDSCI 723 SH</td>
<td>Cancer Pharmacology</td>
<td>15</td>
<td>M. Mckeage</td>
</tr>
<tr>
<td>PHARMCOL 788 DH</td>
<td>BSc (Hons) Dissertation</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>PHARMCOL 796 DH</td>
<td>MSc Thesis</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

**Description of course content**

**MEDSCI 204**
Pharmacology and Toxicology
(Semester Two, three lectures per week and computer-based laboratories).
A principles-based introduction to pharmacology and toxicology. Topics covered include drug targets and action, ADME and pharmacokinetics, drugs of the autonomic system, toxicity and adverse drug reactions, selective toxicity including chemotherapy, antibiotics and antiviral drugs; integrated clinical pharmacology; drug discovery and development.

**Assessment:**
- Laboratories: 40%
- Mid-semester test: 10%
- Final exam: 50%

**MEDSCI 304**
Molecular Pharmacology
(Semester One, two lectures and one tutorial per week. Two-day laboratory intensive held during midsemester break).
This course explores the cellular and molecular mechanisms of drugs acting at receptors, with a particular focus on G-protein coupled receptors. The lectures explore how receptors signal and traffic through cells and the implications of these processes on drug development and design. The tutorials are designed to support the course material by providing the opportunity to critically evaluate experimental data and learn about experimental methodology and design.

**Assessment:**
- Laboratory write-up/tutorials: 30%
- Laboratory test: 10%
- Mid-semester test: 10%
- Final exam: 50%

**MEDSCI 303**
Drug Disposition and Kinetics
Semester One, two lectures and one laboratory per week
This is a basic course on the principles of pharmacology. The topics include: passage of drugs across membranes; drug absorption, distribution, metabolism and excretion; pharmacokinetics; drug-drug interactions, novel drug delivery systems; mechanisms of drug action; pharmacogenetics and pharmacogenomics; drug analysis and drug dispositions in selected populations, including the elderly, children & neonates, in pregnancy, and in various pathological conditions.

**Assessment:**
- Laboratory write-up/tutorials: 30%
- Laboratory test: 10%
- Mid-semester test: 10%
- Final exam: 50%

**Medicine**
Clinical pharmacology is taught in the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Pts</th>
<th>Clinical Pharmacology Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8CHB 221 A/B</td>
<td>M8CHB Part II</td>
<td>120</td>
<td>N. Holford</td>
</tr>
<tr>
<td>M8CHB 401 A/B</td>
<td>M8CHB Part IV</td>
<td>120</td>
<td>S. O'Sullivan</td>
</tr>
<tr>
<td>M8CHB 501 A/B</td>
<td>M8CHB Part V</td>
<td>120</td>
<td>S. O'Sullivan</td>
</tr>
</tbody>
</table>

A/B = Double Semester, Medical & Health Sciences Campus
MEDSCI 305

Systems Pharmacology
(Semester Two, two lectures and one laboratory per week)
This course considers the modification by drugs of human systems under physiological and pathological conditions. Consideration will be given to the cardiovascular, gastrointestinal, reproductive, respiratory and the central nervous systems. The cellular and molecular mechanisms of action of the drugs are considered.

Assessment:
Practicals 25%
Project 15%
Mid-semestertest 10%
Final exam 50%

MEDSCI 306

Principles of Toxicology
(Semester Two, two lectures and one laboratory per week)
This course introduces the principles and concepts involved in toxicology. The lectures cover the general mechanisms involved in the toxicity of foreign compounds, including the formation and detoxification of chemically reactive metabolites and their interactions with macromolecular targets. The course describes the secondary and tertiary consequences of these interactions, such as direct toxicity, genotoxicity and hypersensitivity reactions, plus the basis of organ-selective toxicity. The course covers the toxicity of compounds such as drugs, food additives and contaminants, plant and animal toxins as well as environmental toxicants.

Assessment:
Mid-semestertest 10%
Project presentation 15%
Practicals 25%
Final exam 50%

MEDSCI 307

Neuropharmacology
(Semester One, two lectures and one laboratory per week)
This course introduces the principles and concepts involved in neuropharmacology. It covers the anatomy, neurochemistry and pharmacology of the normal and diseased human brain; the biochemical causes of psychiatric and neurological diseases; and the types and mechanisms of action of drugs used to treat human brain disorders.

Assessment:
Mid-semestertest 15%
Laboratory test 15%
Laboratory reports 10%
Final exam 60%

MEDSCI 701

Special Studies in Medical Science
Special topics in pharmacology may be arranged with the permission of the HOD after consultation with supervisor.

Assessment:
Course work 100%

MEDSCI 715

Molecular Toxicology
This course involves advanced study into the role of metabolism (including induction/inhibition and genetic polymorphisms) in the toxicity of xenobiotics and molecular events following exposure to toxic xenobiotics, such as mutagenesis, teratogenesis and apoptosis. The toxicity of several classes of drugs, including anticancer, antibacterial and antimarial drugs is also studied in detail, as well as the application of toxicological principles in drug safety evaluation.

Assessment:
Project presentation and essay 25%
Final exam 75%

MEDSCI 716

Advanced Drug Disposition and Kinetics
This course is concerned with the advanced study of: the absorption, distribution, metabolism and excretion of drugs; in vivo and in vitro techniques for ADME studies; pharmacokinetics and pharmacogenomics in drug development.

Assessment:
Course work 30%
Final exam 70%

MEDSCI 717

Advanced Neuroscience: Neuropharmacology
An advanced discussion of current research in neuroscience. The course will involve critical analysis of the literature within the context of a series of major research themes. Each theme will encompass models from molecular through to systems level neuroscience. In this course, themes will be selected from the following areas: neuroscience, neurodegeneration and addiction.

Assessment:
Course work 50%
Final exam 50%

MEDSCI 718

Pharmacology of Anaesthetics/Analgesics
This course deals with the general aspects of anaesthetics and analgesics. Topics covered include the development of modern anaesthesia, the mechanisms of action of drugs used in general and local anaesthesia, and issues surrounding safety and efficacy of anaesthesia, including drug error and circadian variation in drug action.

Assessment:
2000 word essay 25%
Seminar presentation 5%
Final exam 70%

MEDSCI 719

Pharmacometrics
This course deals with the application of mathematical models to interpretation of pharmacological observations. Models provide an explanation for experimental observations as well as a description. Computer based analysis methods are used for individuals and populations. Typical areas of application are pharmacokinetics, pharmacodynamics, ligand binding, enzyme kinetics and time course of drug effect.

Assessment:
Course work 50%
Final exam 50%

MEDSCI 720

Biomedical Research Techniques
Introduction to a broad base of research techniques ranging from tissue culture through
microscopy to gene cloning and RNA interference. Emphasis is on theoretical basis, application and interpretation.

**Assessment:**

Course work 60%
Written test 40%

**MEDSCI 721**

**Advanced Toxicology**

The course addresses current issues and recent advances in toxicology. This course is aimed primarily at students wishing to undertake research in a field related to toxicology.

**Assessment:**

Course work 100%

**MEDSCI 722**

**Clinical Pharmacology**

This course deals with the target concentration strategy and clinical pharmacokinetics; disease progress and variability in drug response; adverse drug reactions and evaluation of clinical trials. Drug disposition and action in the elderly, young and in pregnancy will also be considered. Emphasis is placed on the use of medicines in humans and application of clinical pharmacology to drug development.

**Assessment:**

Course work 25%
Final exam 75%

**MEDSCI 723**

**Cancer Pharmacology**

This course focuses on the clinical pharmacology and development of drugs for treating cancer. The course deals with the main classes of anticancer drugs, including alkylating agents, platinum-based drugs, antimetabolites, topoisomerase-active drugs, antimicrotubule agents, targeted therapies and vascular targeting drugs. Other topics include the pharmacological basis of cancer chemotherapy, pharmacological variability and individualisation of cancer therapy, oncology clinical trials, drug interactions and combination chemotherapy, and selected research topics.

**Assessment:**

Course work 40%
Final exam 60%

**BSc (Hons) in Pharmacology**

Students must undertake 75 points in courses from the 700 level pharmacology courses and complete a 45 point dissertation of a research project by the end of the second semester.

**Diploma in Pharmacology**

Pharmacology courses (Stage III) may also be taken as part of the Diploma in Science (DipSci) and (stage IV courses) the postgraduate Diploma in Science (PGDipSci). Students are referred to the current University Calendar for further information regarding these diplomas.

**PGDipSci or PGDipHSci**

At least 60 points from MEDSCI 701 (or 702), 715-723, and up to 60 points from other 700 level courses as approved by Head of Department.

**MSc or MHSc**

120 point Masters thesis in pharmacology.

**Possible careers**

The study of the way in which drugs work is the basis for a number of career possibilities. Some of these are briefly listed below and give examples of the opportunities available.

**Teaching and Research in Higher Educational Institutions**

In New Zealand most teachers of pharmacology are concerned with training students for the medical, veterinary and pharmaceutical professions. Pharmacology is also taught to science students at the University of Auckland and University of Otago. It should be noted that appointment to a university teaching post usually requires the possession of a research degree or equivalent experience.

**Biotechnology and Pharmaceutical Research and Development**

The discovery and development of new and better medicines for the treatment of diseases in man and animals, as well as chemicals for food processing and agricultural application requires pharmacologists as part of the multidisciplinary research and development teams. The pharmaceutical industry is a major source of employment opportunities but this mostly occurs overseas in Europe, the US and also Japan. In New Zealand pharmaceutical research is mainly confined to clinical trials with little basic pharmacological research being undertaken. However a number of small Biotech companies have started in New Zealand and offer some career opportunities. Pharmacologists can also find key roles in the medical, regulatory and marketing divisions of the pharmaceutical industry in New Zealand.

**Clinical Teaching and Research**

Medically qualified clinical pharmacologists are employed by pharmaceutical companies for evaluating drug activity in patients. In these studies, their work is supported by non-clinically qualified graduates and non-graduate technicians who contribute to the laboratory aspects of the clinical studies. Increasingly, more offices of multinational pharmaceutical companies and clinical research organisations are offering posts for clinical research assistants.
Government Department and Research Institutions

A number of opportunities are available for work in Government or government-sponsored research institutions. Examples of the type of work available are: research and development studies, assessment of the cost and safety of medicines and advisory and safety aspects of chemicals used in the food processing and agricultural industries. In addition there are a number of private research institutions and companies, such as the Auckland Cancer Society Research Centre (ACSRC) in Auckland, which is sponsored by the New Zealand Cancer Society, and the Malaghan Institute of Medical Research in Wellington which can provide research opportunities for pharmacologists.

Medical Publishing and Drug Information

A background in pharmacology and toxicology is ideal for entry into medical publishing and drug information dissemination. There are many opportunities in this expanding field. For example, Adis International is an international publishing and drug information company which has its headquarters at Mairangi Bay in Auckland.

Toxicology

A pharmacology/toxicology qualification is one of the principal entry routes into employment as a toxicologist. The training and ability to appreciate and measure the many aspects involved in the assessment of drug action and the adverse effects of chemicals forms an ideal basis for a career in toxicology. Toxicologists are employed in all the career categories mentioned above. The increasing use of food additives and agricultural chemical products, and increasing environmental hazards arising from pollution provide additional areas of career employment.

2016 academic year

<table>
<thead>
<tr>
<th>Semester One – 2016</th>
<th>Semester Two – 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester One begins</td>
<td>Monday 29 February 2016</td>
</tr>
<tr>
<td>Course withdrawal deadline</td>
<td>Friday 11 March</td>
</tr>
<tr>
<td>Course withdrawal deadline (double semester course)</td>
<td>Friday 25 March</td>
</tr>
<tr>
<td>Easter break</td>
<td>Friday 25 March – Tuesday 29 March</td>
</tr>
<tr>
<td>ANZAC Day</td>
<td>Monday 25 April</td>
</tr>
<tr>
<td>Graduation</td>
<td>Friday 6 May, Monday 9 May and Wednesday 11 May</td>
</tr>
<tr>
<td>Lectures end</td>
<td>Friday 3 June</td>
</tr>
<tr>
<td>Study break</td>
<td>Saturday 4 June – Wednesday 8 June</td>
</tr>
<tr>
<td>Queen’s Birthday</td>
<td>Monday 6 June</td>
</tr>
<tr>
<td>Examinations</td>
<td>Thursday 9 June – Monday 27 June</td>
</tr>
<tr>
<td>Semester One ends</td>
<td>Monday 27 June</td>
</tr>
<tr>
<td>Inter-semester break</td>
<td>Tuesday 28 June – Saturday 16 July 2016</td>
</tr>
<tr>
<td>Semester Two begins</td>
<td>Monday 18 July 2016</td>
</tr>
<tr>
<td>Course withdrawal deadline</td>
<td>Friday 29 July</td>
</tr>
<tr>
<td>Mid-semester break</td>
<td>Monday 29 August – Saturday 10 September</td>
</tr>
<tr>
<td>Graduation</td>
<td>Tuesday 27 September</td>
</tr>
<tr>
<td>Lectures end</td>
<td>Friday 21 October</td>
</tr>
<tr>
<td>Study break</td>
<td>Saturday 22 October – Wednesday 26 October</td>
</tr>
<tr>
<td>Labour Day</td>
<td>Monday 24 October</td>
</tr>
<tr>
<td>Examinations</td>
<td>Thursday 27 October – Monday 14 November</td>
</tr>
<tr>
<td>Semester Two ends</td>
<td>Monday 14 November 2016</td>
</tr>
<tr>
<td>Semester One – 2017</td>
<td>Semester One begins</td>
</tr>
</tbody>
</table>