Welcome to JCSMR

Honours/Masters research year is challenging but also an exciting and incredibly rewarding experience: this is your first chance to be part of a laboratory group doing cutting edge science. Honours/Masters provide the opportunity to become a valued member of the scientific community. You will develop skills in laboratory-based research, inductive reasoning, literature analysis, written and oral communication, which will help to launch your career in Biomedical Research or a related field.

This short guide gives an overview of the projects available in our four Departments but also provides some information about the application process.

We trust you will have a fabulous year full of discovery and inspiration, both academically and personally, and will develop a great enthusiasm for Biomedical Research.

Do not hesitate to contact us if you have any questions or concerns.

Associate Professor Ian Cockburn, course convenor
Associate Professor Anneke Blackburn
**The Blackburn Group - Cancer Metabolism & Genetics**
- Genetic factors involved in breast cancer susceptibility in mice and humans
- Treatment and prevention of cancer by targeting cancer cell metabolism with dichloroacetate

Dr Maurits Evers
**The Hannan Group - Cancer Therapeutics**
- Identification of genetic signatures of acquired resistance to Pol I transcription inhibitors in cancer
- Application of Bayesian modelling of high-throughput genomic data to obtain robust and interpretable estimates of model parameters
- Robust and reproducible high-throughput data analysis workflow using snake-make
- Simulation of “in-silico” genomic high-throughput sequencing data to assess and benchmark results from different computational tools, and to guide parameter optimisation

Associate Professor Elizabeth Gardiner
**The Gardiner Group - Mechanisms of Thrombosis & Cancer**
- The molecular architecture of a thrombus in flowing blood
- The molecular pathology of platelet-based autoimmune diseases
- Investigating the role of platelets, neutrophils and other vascular cells in the tumour vascular environment, driving tumour metastasis and cancer-related thrombosis
- Metalloproteinase activity in metastatic and non-metastatic tumours
- Platelet-tumour cell interactions in flowing blood

Dr Amee George
**The Hannan Group - Cancer Therapeutics**
- Use of robotic high throughput screening approaches to the role of nucleolar surveillance in regulating the tumour suppressor p53
- Understanding the molecular mechanisms mediating ribosomopathies as a means to identify novel approaches for their treatment

ACRF Department of Cancer Biology and Therapeutics
Dr Kate Hannan  
The Hannan Group - Cancer Therapeutics  
> Understanding the role of the Pol I transcription factor UBF in regulation rDNA chromatin through high throughput functional screens  
> Discovery of novel Pol I inhibitors as therapeutics for cancer and their translation to Phase I/II clinical trials  
> Understanding how Pol I inhibitors synergise with standard and novel therapies to overcome drug resistance in cancers.

Professor Ross Hannan  
The Hannan Group - Cancer Therapeutics  
> Genetic and epigenetic regulation of ribosomal RNA gene transcription during malignant transformation  
> Development of novel small molecule therapies targeting the ribosome to treat cancer  
> The role of RiBi in differentiation and high throughput functional screening approaches to understand ribosomopathies

Dr Nadine Hein  
The Hannan Group - Cancer Therapeutics  
> Investigating the regulation of rDNA chromatin and Pol I transcription during differentiation, including dynamic changes in long range chromosomal interaction with the rDNA chromatin  
> Elucidating the role of Pol I transcription and RiBi factors in stem cell maintenance and pluripotency  
> Understanding how is Pol I transcription regulated in cancer stem cells and can this be therapeutically targeted to eradicate these cells

Dr Keisuke Horikawa  
The Quinn Group - Cancer Models  
> Mouse models for lymphoma associated mutations  
> Mouse models for lymphocyte signalling pathways

Dr Steve Lee  
The Gardiner Group - Mechanisms of Thrombosis and Cancer  
> Developing laser-induced vascular injury models in mice  
> Measuring cellular mechanosensing with lightsheet microscopy  
> Understanding multiphoton photomodulation for genetic and drug delivery

Professor Chris Parish  
The Parish Group - Cancer and Vascular Biology  
> Role of heparan sulfate and heparanase in tumour growth and metastasis and in autoimmunity  
> Investigating the role of heparan sulfate in T cell development in the thymus  
> Investigating why sarcomas are more highly metastatic than carcinomas  
> Development of novel drugs that inhibit a range of immunopathologies, such as sepsis, by neutralising extracellular histones  
> Designing novel cancer immunotherapies

Associate Professor Leonie Quinn  
The Quinn Group - Cancer Models  
> Identify new tumour markers and drug targets, by dissecting complex signalling and transcriptional mechanisms underlying cancer using Drosophila developmental models combined with molecular genetics  
> Determine how the stem cell microenvironment or “niche” behaves to prevent cancer stem cell formation and tumour progression  
> Elucidate molecular mechanisms driving brain tumours, ovarian cancer and leukaemia
Department of Immunology and Infectious Disease

Associate Professor Ruth Arkell
The Arkell Group - Early Mammalian Development
> Understanding how genetic mutations cause congenital disease
> Using CRISPR modified mice and cells to investigate gene expression

Dr Anne Bruestle
The Bruestle Group - Inflammatory T Cell Responses/Autoimmune Models of Neuroinflammation
> Migration, effector function and transcriptional regulation of Th17 cells
> Neutrophils and their extracellular traps in MS pathology
> Tissue specific factors of Th17 cell mediated autoimmunity

Dr Gaetan Burgio
The Burgio Group - Genome editing/Genetics of Host-pathogen interactions
> Genetics of the host response to multi-drug resistant bacteria or ‘superbugs’
> Development of CRISPR/Cas9 genome editing technology

Associate Professor Ian Cockburn
The Cockburn Group - Malaria Immunology
> Using live imaging to determine how T cells find pathogens in the liver
> How does the immune system mount antibody responses against the malaria parasite?

Professor Matthew Cook
The Cook Group - Translational Immunology/Centre of Personalised Immunology
> Monogenic human immune deficiency disease
> Gene regulation in human neutrophils from patients with systemic vasculitis
> NF-kB signalling in human inflammatory disease?
Dr Julia Ellyard  
**The Vinuesa Group - Genetics of Autoimmunity**  
> Identifying genetic variants that induce autoimmune disease  
> Understanding the cellular and molecular pathways that cause autoimmune disease

Associate Professor Anselm Enders  
**The Enders Group - Immunization Genomics**  
> B cell development and function  
> Primary human immunodeficiencies  
> Regulation of the actin cytoskeleton in immune cells

Dr Si Ming Man  
**The Man Group - Innate Immunity and Inflammasome**  
> Uncovering how host cells recognise and respond to intracellular pathogens and danger signals  
> Unravelling the molecular mechanisms of inflammasome formation  
> Understanding the role of cytoplasmic innate immune sensors in regulating the development of cancer and the composition of the gut microbiota  
> Identifying novel activators and inhibitors of the innate immune system to prevent and treat infection, autoinflammatory diseases and cancer

Associate Professor Brendan McMorran  
**The McMorran Group - Genetics and Infectious Diseases**  
> Synthetic platelet microbicidal peptides as novel anti-malarial drugs  
> Platelet-erythrocyte interactions in the bloodstream  
> Understanding how platelets protect the host during malarial infection

Associate Professor Charani Ranasinghe  
**The Ranasinghe Group - Molecular Mucosal Vaccine Immunology**  
> Assess novel vaccine adjuvants to enhance mucosal immunity  
> Identification of antigen presenting cell subsets following mucosal vaccination  
> Study IL-4/IL-13 cytokines and their receptor regulation specifically at the mucosae  
> Study different innate lymphoid cell subsets at the mucosae

Associate Professor Charmaine Simeonovic  
**The Simeonovic Group - Diabetes/Transplantation Immunobiology**  
> Contribution of platelets and neutrophils to the development of Type 1 diabetes  
> NET and histone-mediated damage of insulin-producing islet beta cells and prevention  
> The role of heparanase in Type 1 diabetes

Professor David Tscharke  
**The Tscharke Group - Viruses and Immunity**  
> Relating antigen presentation to immune responses  
> Understanding how viruses evade immune responses  
> The role of viral gene expression in herpes simplex virus latency  
> Understanding genetic susceptibility to virus infection

Dr Tonia Woodberry  
**The Bruestle Group - Inflammatory T Cell Responses/Autoimmune Models of Neuroinflammation**  
> Understanding neutrophil and platelet interactions in multiple sclerosis  
> Evaluating anti-cancer drugs for autoimmunity  
> Determining dendritic cell (DC) responsiveness in autoimmunity with a particular focus on DC and neutrophil interactions

Associate Professor Di Yu  
**The Yu Group - T-Cell Immune Mechanism, Monitoring and Modulation (TIM)**  
> The development of low-dose IL-2 therapy for inflammatory and autoimmune diseases  
> The development of superagonist monoclonal antibodies to human IL-21 in immunotherapy for infection and cancer  
> The differentiation and function of follicular cytotoxic T (Tfc) cells in infection and cancer  
> The regulation of follicular helper T (Tfh) cells in vaccination and autoimmune diseases
Dr Dan Andrews  
**The Andrews Group - Genome Informatics**  
> Relative contribution of mutation to disease, including measurement of mutational load in gene networks and complex disease  
> The functional contribution of mutation in related genes and severity of resultant disease phenotype  
> ‘Big data’ information systems to aggregate and mine very large volumes of human genome to identify causal variation specific to disease  
> Human mutation as ‘devolution’ for insight into recent functional evolution

Associate Professor Tamas Fischer  
**The Fischer Group - Epigenetics and Genomic Stability**  
> The role of chromatin in the repression of pervasive transcription  
> Chromatin and RNA surveillance  
> RNA-DNA hybrids in genome stability and DNA repair  
> Development of a molecular tool for personalised cancer treatment: a synthetic biology approach

Dr Rippei Hayashi  
**The Hayashi Group - Transposon defence and Animal Development**  
> Investigate the principle of small RNA substrate specificity  
> Dissect the role of small RNA processing in animal behaviour  
> Uncover the mechanism of novel splicing “rescue” pathways in muscle development  
> Study the higher-order splicing regulation using the long-read sequencing platform

Professor Thomas Preiss  
**The Preiss Group - RNA Biology**  
> Messenger RNA processing diversity in cardiac biology  
> Gene regulation through interactions between RNA, enzymes and metabolites  
> The role of epitranscriptomic marks on RNA in cancer  
> Tracking ribosome footprints to reveal the intricacy and control of translation

Professor David Tremethick  
**The Tremethick Group - Chromatin and Transcriptional Regulation during Development**  
> Uncovering new epigenetic-based regulatory mechanisms of gene expression: novel links between histone variants, RNA function and disease  
> The special role of histone variants in regulating the inheritance and three-dimensional organisation of the epigenome  
> A new paradigm for the control of cellular function: the dynamic reshaping of the epigenome by histone variants
Associate Professor Ehsan Arabzadeh  
**The Arabzadeh Group - Neural Coding**  
- Signal processing in the sensory cortex  
- Sensory decision making in rodent whisker system  
- Neuronal mechanisms underlying selective attention in rodents  
- Sensory adaptation

Professor John Bekkers  
**The Bekkers Group - Olfaction**  
- Electrical properties of neurons in the olfactory cortex  
- Development of olfactory circuits in the brain  
- Epilepsy and olfaction  
- Odour-learning behaviours in mice and the brain circuits that underlie them

Associate Professor Brian Billups  
**The Billups Group - Synaptic Mechanisms in the Central Nervous System**  
- The role of astrocytes in regulating synaptic transmission  
- Mechanisms of neurotransmitter recycling at central synapses  
- NMDA receptor co-agonists and regulation synaptic activation  
- Novel fluorescent probes for measuring brain amino acids

Dr Nathalie Dehorter  
**The Dehorter Group - Neuronal Development**  
- Role of a transcription factor involved in cell identity and function  
- Developmental expression and role of a receptor involved in schizophrenia  
- Early signs of impaired neuronal activity in a mouse model of autism

Professor Ted Maddess  
**The Maddess Group - Diagnostic for Eye Diseases**  
- Multifocal pupillographic objective perimetry  
- Retest variability of ophthalmic instruments  
- Testing for neurological disorders  
- Higher order image statistics and image texture
Dr Riccardo Natoli  
**The Natoli Group - Gene Expression in the Human Macula**  
- Role of miRNA in retinal degenerations  
- The use of miRNA as potential therapeutic targets in diseases causing retinal degenerations  
- Understanding the role of glia in the progression of Age-Related Macular Degeneration  
- Novel therapeutics for reducing inflammation and oxidative stress in the progression of Age-Related Macular Degeneration

Professor Greg Stuart  
**The Stuart Group - Neuronal Signalling**  
- Discovering how neurons integrate information  
- Determining the properties and role of dendrites in neuronal function  
- Understanding how visual information from the eyes is processed by the brain

**Program outcomes**

Upon successful completion, students will have the knowledge and skills to:  
- Plan and engage in an independent medical research investigation;  
- Systematically evaluate evidence and draw appropriate conclusions;  
- Analyse and interpret medical research data with statistical or other evaluative processes;  
- Demonstrate mastery of relevant experimental techniques to collect original research data;  
- Communicate data and complex research concepts clearly and effectively to different audiences.
Important contacts

Course Convenor
Associate Professor Ian Cockburn
lan.Cockburn@anu.edu.au

Student Administrator
Ms Tara Butler
jcsmr.gradprog@anu.edu.au

Applying for Honours at JCSMR

First, contact potential supervisors. Once they have agreed to take you as a Honours student,

- Apply to the program following the instructions available on
  http://science.anu.edu.au/study/how-apply/honours-year-application
  Make sure you nominate the Medical Research Specialisation.

- Complete the JCSMR supplementary form, available on
  http://jcsmr.anu.edu.au/study/honours, including your supervisor’s signature and send it to
  jcsmr.gradprog@anu.edu.au

JCSMR Honours Scholarships

Paul Bunyan Scholarship in Medical Sciences
This scholarship is awarded in memory of Paul Bunyan. It provides a stipend of $6,000 for one year for a Fourth Year (Honours) student in medical science related to cancer research.

Alexander McTaggart Memorial Scholarship
This scholarship is awarded in memory of Alexander McTaggart. It provides a stipend of $6000 for one year for a Fourth Year (Honours) student in medical science related to cancer research and allied fields.

The Joyce Fildes Scholarship in Medical Science
This scholarship has been generously endowed by Dr Joyce Fildes, an original member of The John Curtin School of Medical Research. It provides a stipend of $6000 for one year for a Fourth Year (Honours) student in medical science.

The Helen Winslade Honours Scholarship in Cancer Research
This Scholarship is awarded in memory of Mrs Helen Winslade. It provides a stipend of $6000 for one year for a Fourth Year (Honours) student in medical science related to cancer research.

Angus Nicholson Honours Scholarship in Science
This scholarship is offered by the ANU Joint Colleges of Science & ANU College of Physical and Mathematical Sciences. The scholarship has been generously established by Mr Jon Nicholson, in memory of his late father, Dr Angus Nicholson.