THE UNIVERSITY OF MELBOURNE

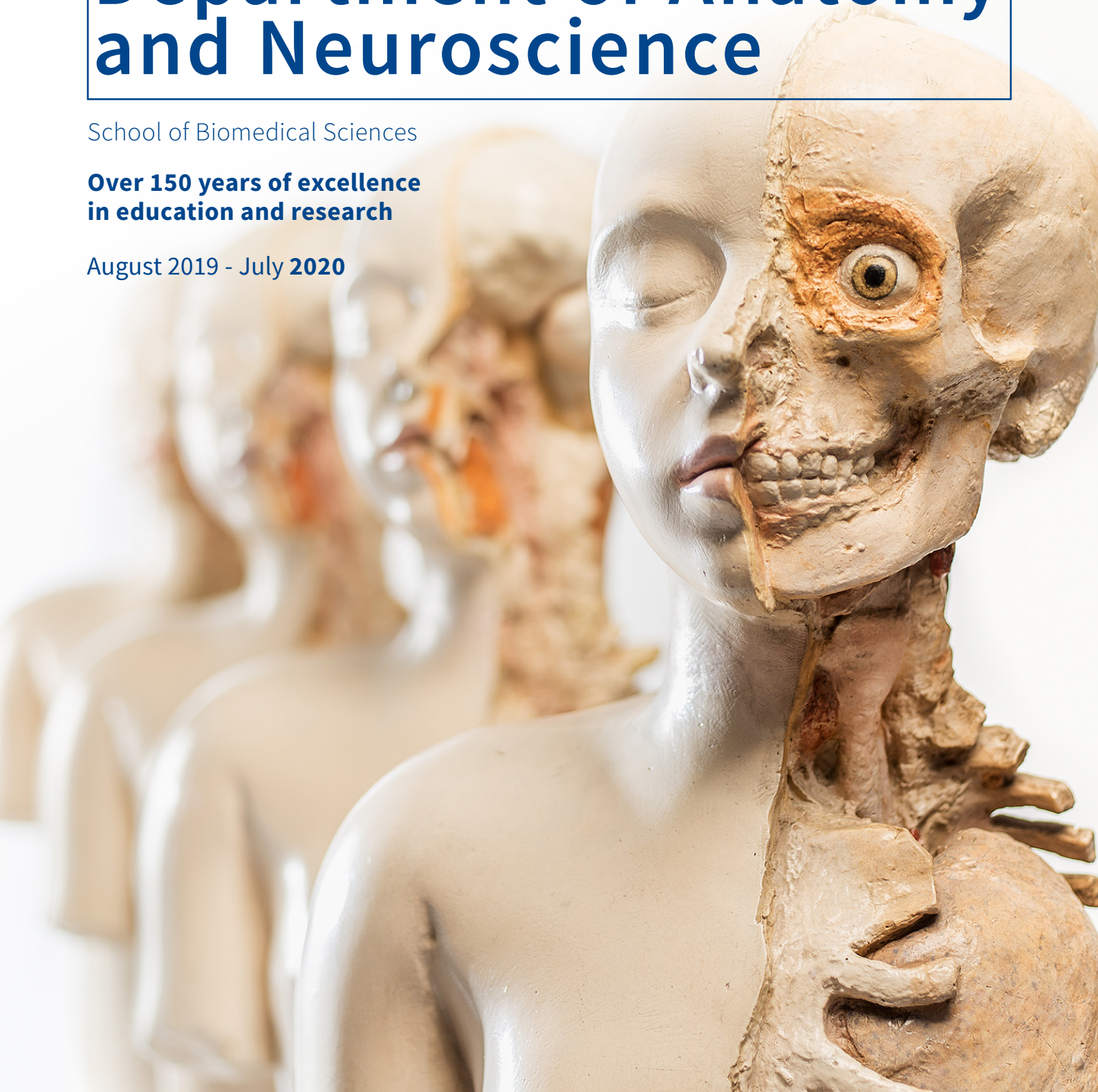
Faculty of Medicine, Dentistry and Health Sciences

Department of Anatomy and Neuroscience

School of Biomedical Sciences

Over 150 years of excellence in education and research

August 2019 - July **2020**



Welcome

As a founding Department of the Faculty of Medicine Dentistry and Health Sciences at The University of Melbourne, the Department of Anatomy and Neuroscience has a long-standing history of excellence in education and research. We are home to over 152 staff and students comprising world-class investigators whose research spans three main themes. These activities are supported by confocal microscopy, molecular biology, cell culture and histology core units as well as other facilities.

Research Themes

1. **Autonomic and Sensory Nervous Systems.** Includes understanding the digestive, urogenital and respiratory systems and retina in development, health and disease. Demyelinating diseases such as multiple sclerosis are also studied.
2. **Cell and Developmental Biology.** Includes stem cell biology and genetics, reproductive biology, vascular development, eye development; and developmental biology of the nervous system.
3. **Anatomical Sciences.** This research theme is critical for improving anaesthetic approaches to pain management and for developing an evidence-based approach to surgery.

Education

We are dedicated to quality teaching at the undergraduate, graduate and postgraduate levels led by teaching specialists and teaching-research academics. We utilize innovative teaching methodologies to deliver our unique and popular courses which includes the highly prestigious Graduate Diploma of Surgical Anatomy accredited by the Royal Australasian College of Surgeons.

Our **mission** within this environment is to support and train highly qualified students who will go on to excel in their chosen career paths which range from independent research scientists, clinicians, clinician-researchers and allied health professionals.

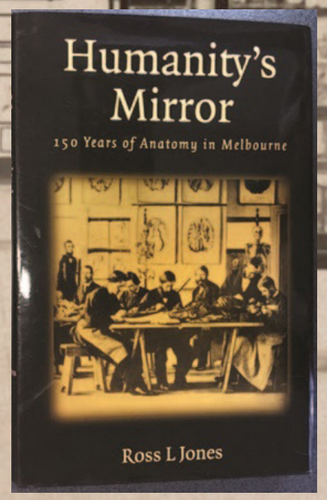
I look forward to welcoming you to the Department.

Professor Jennifer Wilkinson-Berka
Head, Department of Anatomy and Neuroscience

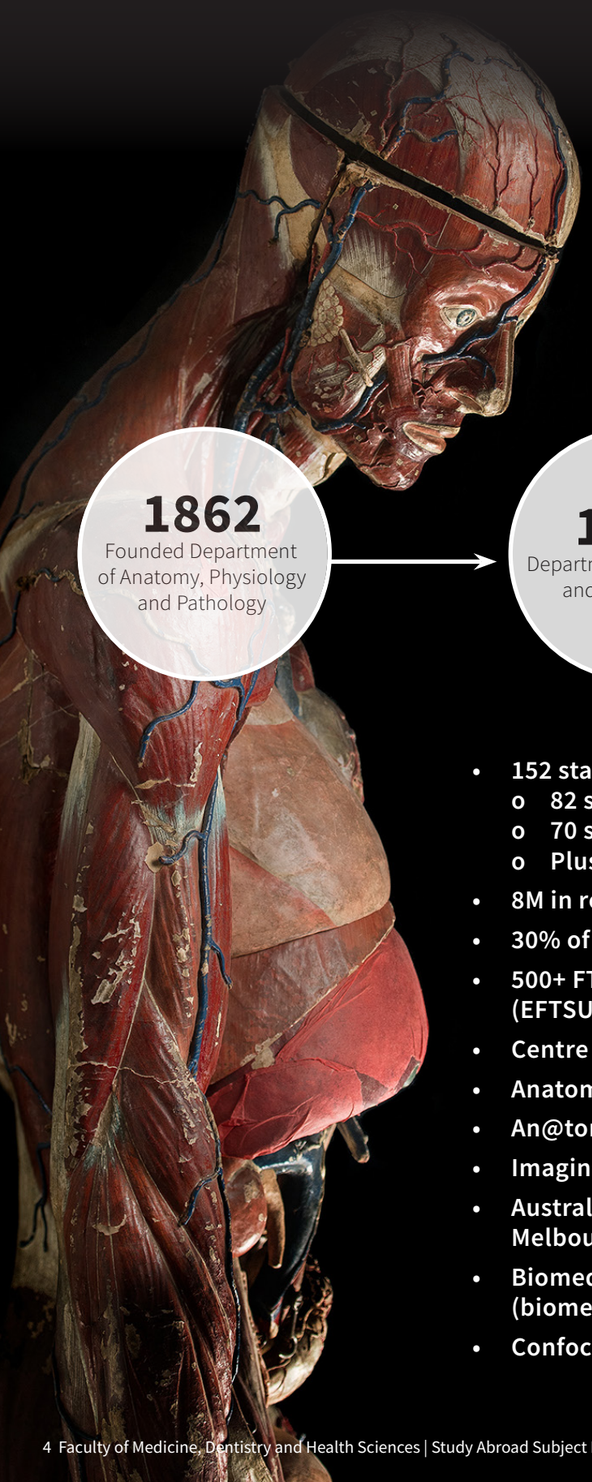
We foster a culture that supports innovation, equity and diversity.

History

The Department of Anatomy was founded in 1862, originally as the Department of Anatomy, Physiology and Pathology. In addition to its roles in teaching and research, it coordinates the largest and oldest body donor program in Australia. Since its founding, it has been led by 14 Heads of Department. During the 1990s, cell biology became a major part of the Department's teaching and research activity. Consequently, the Department became the Department of Anatomy and Cell Biology in 1993. Similarly, in 2012 in response to increasing research and teaching activity in neuroscience, the Department became the Department of Anatomy and Neuroscience. The Department held a very successful 150th year celebration in 2012 and commemorated the occasion with the commissioning of a book, 'Humanity's Mirror' by Ross L Jones, that describes the history of the Department and its role in society over the last 150 years.



Anatomy and Neuroscience at a Glance



1862
Founded Department of Anatomy, Physiology and Pathology

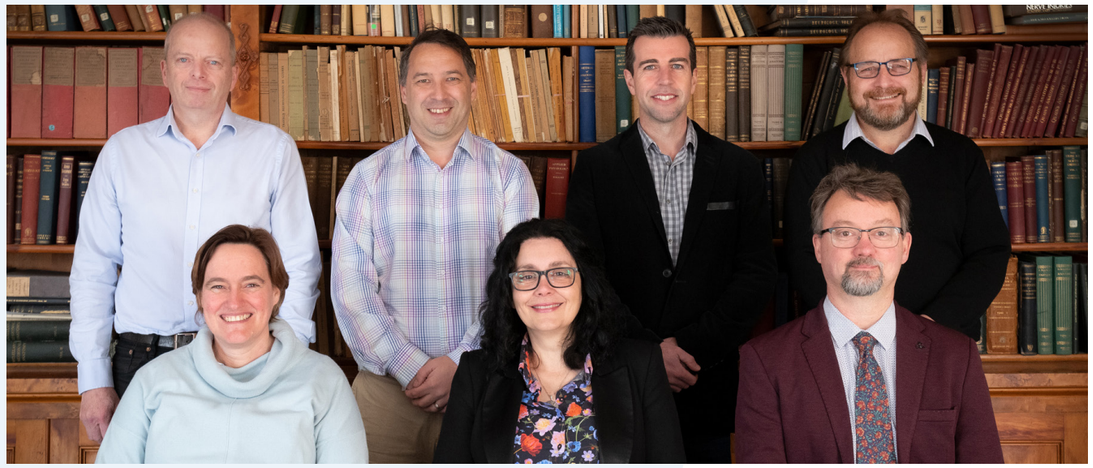
1993
Department of Anatomy and Cell Biology

2012
Department of Anatomy and Neuroscience

- 152 staff and students
  - 82 staff members
  - 70 students
  - Plus 53 Honorary staff
- 8M in research funding in 2018
- 30% of publications in the top 10% of journals
- 500+ FTE equivalent undergraduate fulltime student load (EFTSUL)
- Centre for Stem Cell Systems and Stem Cell Australia
- Anatomical Skills Workshops
- An@tomedia
- Imaging + Posters (anatomy-poster@unimelb.edu.au)
- Australian Phenomics Network Histopathology Service Melbourne (apn-info@unimelb.edu.au)
- Biomedical Sciences Histology Facility (biomedsci-histology@unimelb,edu.au)
- Confocal microscopy (bomp-enquiries@unimelb.edu.au)

Our Executive Committee

The Department of Anatomy and Neuroscience is committed to research excellence and innovation that advances biomedical science and human health. We are proud of the passion all staff share for teaching excellence and engaging the broader community in their research journey.



Seated (L to R): Professor Erica Fletcher (Chair of Research Committee, School of Biomedical Sciences), Professor Jennifer Wilkinson-Berka (Head of Department) and Professor Gary Hime (Deputy Head of Department)

Standing (L to R): Dr Peter Kitchener (Postgraduate Research Coordinator), Associate Professor Jason Ivanusic (Head of Anatomy Teaching), Professor Stuart Mazzone (Deputy Head of Research / Chair of Research Committee), Associate Professor Robb de Iongh (Deputy Head of Teaching / Academic Programs Coordinator)

Absent: Professor Christine Wells (Director – Centre for Stem Cells Systems) and Dr Kathy Avent (Strategy and Operations Manager)

Our Research Committee

L-R: Professor Erica Fletcher, Dr Mike Clark, Professor Stuart Mazzone (Chair), Denise Dwyer

Standing: Dr Andrew Jobling, Dr Jenny Gunnerson, Dr Peter Kitchener, Dr Marlene Hao, Dr Alice McGovern.

Our Teaching Strategy Committee

L-R: Dr Charlotte Clark, Dr Peter Kitchener, Dr Michelle Rank, Associate Professor Quentin Fogg, Associate Professor Robb de Iongh (Chair)

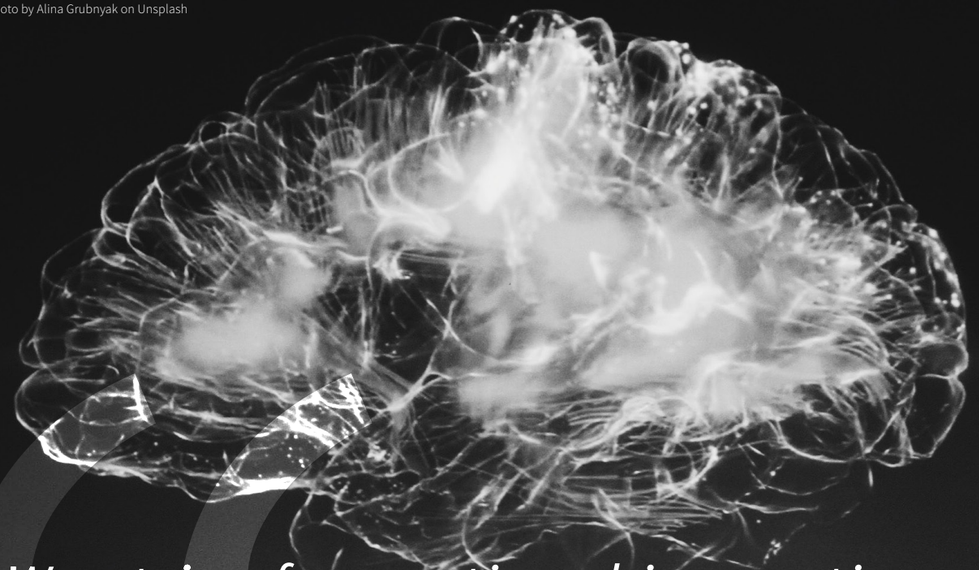
Teaching and learning

The Department of Anatomy and Neuroscience contributes to a range of undergraduate subjects in three inter-related discipline areas, which are reflected in the three majors open to Science and Biomedicine degree students, administered through the Department. The Department also offers the Graduate Diploma in Surgical Anatomy and contributes to several other postgraduate courses in the Doctor of Physiotherapy, Doctor of Medicine, Master of Biotechnology and Masters/PhD programmes.

Undergraduate Teaching – The Majors

Human Structure and Function. This major examines how the human body works and is based on a deep understanding of the relationship between anatomy (structure) and a range of other subjects that can be integrated to introduce elements from physiology, pathology, pharmacology and zoology (function). This provides both depth and breadth of understanding for students studying this major. There are particular emphases on being able to apply this understanding to solve problems in broad healthcare and research settings and on understanding how significant variations in human structure and different presentations of human anatomy can influence function. Students attain problem-solving skills developed through designing and implementing investigations of human structure and function, including but not limited to a significant programme of cadaveric dissection. It is the most popular major in the School and suits students wishing to pursue careers in: medical and health-related sciences; postgraduate research work in applied anatomy and physiology; teaching and research in University departments or in hospitals; pharmaceutical and surgical companies; media liaison, consultancies and scientific journalism.

Photo by Alina Grubnyak on Unsplash



We strive for continual innovation in the education of Human Structure and Function, Neuroscience and Cell and Development Biology

Neuroscience. Neuroscience is one of the largest areas of study within the entire sphere of modern biology and an area where Australian research has significant international impact. Students completing a neuroscience major will understand the fundamental organisation and functional principles of the nervous system: from the biology of nerve cells and neural circuits through to neural systems and complex behaviours. From the two core subjects (Principles of Neuroscience; Neurophysiology: Neurons and Circuits) students gain an overview of the breadth of modern neuroscience and how it interrelates with aspects of molecular and cell biology, physiology, psychology, cognitive and information science. The diversity of neuroscience is reflected in the range of subjects that complement the two compulsory subjects. These electives allow further study of the nervous system at the molecular and cellular level, and at a systems level of neural organisation. The most current data indicate that the Neuroscience major is the second most popular of the 15 Biomedical Science majors (after Human Structure and Function). Neuroscience subjects are also popular as electives in other majors, and Principles of Neuroscience has one of the largest enrolments among 3rd year science subjects ~ 800 students.

Cell and Developmental Biology. This major was established to develop a truly cross-disciplinary approach to disciplines that arose historically out of histology, embryology, biochemistry and genetics. It aims to provide students with a broad understanding of cell structure and function and explores genetic molecular and cellular mechanisms of embryonic development in a range of organisms and experimental models. It was a natural fit to collaborate with the departments of Zoology, Genetics and Botany (now the School of Biosciences) and the result is one of the most multi-disciplinary majors in the Bachelor of Science and Biomedicine. The core subject, which introduces students to core concepts in the field of cell and developmental biology, can be combined with subjects that cover various discipline areas, including reproductive biology, embryonic development, cell biochemistry, stem cell biology, plant developmental biology, and biotechnology. Students also have a wide choice of electives that provide for greater flexibility and cross-disciplinary studies in disciplines that relate to cell and developmental biology, including genomics, neuroscience, microbiology and immunology and pathology.

Transition to Postgraduate Research Training – Honours & Masters

For students interested in exploring a research interest, the Department has a very active and vibrant Honours programme (25 to 30 students per year), which involves two semesters of research-oriented coursework and a research project supervised by our research staff. The Master of Biomedical Science, a two-year programme, is a relatively new offering and is growing in popularity with our students as they appreciate the benefits of linking professional degree subjects with intensive study in a specific research discipline. Departmental teaching and research staff also actively contribute to the research-focussed coursework in these programmes, in particular a subject focused on biological microscopy and analysis. Our Honours and Masters graduates go on to conduct a PhD, enter the professional postgraduate health degrees, follow careers in the biotechnology sector or as research staff at the University or at other research institutions.

Below: Dr Peter Kitchener, Coordinator: Graduate Research

Research Higher Degrees

A cornerstone of the Department's research activity and reputation is the training of our postgraduate students. At any one time, the department has 30 to 40 students pursuing their PhD studies, funded by various government, institutional and philanthropic scholarships, in laboratories associated with the department. The Department has a strong culture of nurturing and fostering our research students via multi-member progress committees, postgraduate student retreats, sponsored conference attendance and early career researcher programmes, including School symposia. As a result, the completion rates and timely completion rates are above Faculty averages.

Postgraduate Professional Health Qualifications

Doctor of Medicine

The first year of the postgraduate MD programme involves teaching the fundamental biosciences to ~370 medical students in a large foundational biomedical science subject, which integrates nine disciplines across twelve blocks. Many departmental staff contribute specialist lectures and act as block coordinators within this extensive programme. A strong feature of the MD1 is the topographic anatomy teaching, involving cadaver dissection, integrated with digital anatomical tools (e.g. Anatomedia®). An exciting new development is the recent acquisition by the department of digital anatomy tables (Sectra), which provide for unique interactive anatomy learning with real-life anatomy images of dissections, pathology, histology and clinical cases. These additions, together with the extensive resources of the Harry Brookes Allen Museum and our dissection suites, provides world-class teaching resources for our undergraduate and postgraduate professional students.

Doctor of Physiotherapy

Similar to the MD programme, the first year of the postgraduate Physiotherapy programme involves teaching foundational musculoskeletal, neuroscience, cardiothoracic sciences to ~110 students in a semester long integrated subject. This subject, coordinated and taught by a number of staff within the Department, integrates anatomical, physiological and pharmacological principles that are central to the practice of physiotherapy.

Graduate Diploma in Surgical Anatomy (GDSA).

The GDSA is a qualification offered by the Department for the past 20 years. This unique programme of lectures, tutorials, wet specimen workshops and a comprehensive full body dissection course is accredited by the Royal Australasian College of Surgeons (RACS) to reinforce and advance anatomical knowledge and dissection skills for medical graduates. It not only helps candidates prepare for the Generic Surgical Sciences Examination (GSSE) offered by RACS, but also aims to elevate anatomical knowledge to a level required for excellence in the early years of specialist surgical training. The GDSA is an integral part of the pathway to a Surgical Education and Training (SET) position in Australasia.

Surgical Workshops and Teaching to External User Groups

The topographical dissection suites within the department are regularly used for continuing education, professional development and training workshops by surgeons, medical and surgical suppliers, paramedical groups and other teaching institutions (e.g. RMIT, La Trobe University and Victoria University). These intensive workshops are often held on weekends, out of semester teaching periods or in the evenings to provide unique opportunities for surgical specialists to develop and hone new surgical skills, test procedures for and utility of new devices. Other workshops have also been conducted in conjunction with departments of Speech Pathology, Physiotherapy and the Victorian College of the Arts.

Quentin Fogg - Associate Professor in Clinical Anatomy

Photo by Jesse Orrico on Unsplash

The Harry Brookes Allen Museum of Anatomy and Pathology

The Harry Brookes Allen Museum of Anatomy and Pathology is one of Australia's largest and oldest collections of human tissue specimens. The museum is used for scheduled tutorials and workshops and is also a popular study space.

The bulk of the collection is made up of specimen pots – human tissue dissections preserved in a formalin solution and housed in a Perspex container. In addition to the pots, the collection comprises skeletal material of both humans and animals, corrosion casts (injected resin casts of vascular networks), plastic models, 3D prints and plastinated specimens.

The museum also has a significant collection of historic anatomical models. Primarily manufactured in France and Germany in the late 19th and early 20th century, these models are made from wax, Papier-mâché and plaster.

This section of the Harry Brookes Allen Museum represents one of the largest such collections outside of Europe.

Our Museum houses a fascinating collection of human tissue specimens.

Anatomical Services/ Body Donor program

The Department of Anatomy and Neuroscience coordinates the only Body Donor Program in Victoria. It has been in operation since 1882 and is the oldest and largest program in Australia. The program is a unique and significant component of the Department that supports anatomical examination and the teaching and study of anatomy.

Bodies that have been donated to the program are used in the education and training of future healthcare professionals including medical, dental, physiotherapy, science and nursing students and are also used for the advanced training of surgeons and other specialists.

The program is well supported by the Victorian community. Over the previous five years, the level of donors registering with the program has increased substantially. This is also reflected in the increase of donors accepted at the time of their death.

The Department hosts an annual Commemorative Thanksgiving Service to acknowledge the generosity of our donors. This Service is attended by family and friends of our body donors, along with anatomy staff and students of the Department.

The Service includes spoken reflections from anatomy students, the lighting of individual candles acknowledging each donor and personalised hand-written thank you cards from current anatomy students for family members. A poem is also composed for the event and recited on the evening by the poet. The Service provides an opportunity for family members to gain further understanding and appreciate the importance of their loved one's gift. There is a unique opportunity at the end of the service for families to meet with students and receive further insight into the value of their loved one's contribution to their education.

A sculpture has been recently commissioned and is situated on campus in honour of our donors. It serves both as a daily reminder to staff and students of the donor gift and as a site of remembrance for family and friends to visit year-round.

Research

- **The Department of Anatomy and Neuroscience is recognised internationally for Neuroscience and Cell and Developmental Biology research focused on disease.**
- **We have a rapidly emerging research theme in the discipline of Anatomical Sciences**
- **21 research groups exist within the Department led by Departmental Teaching and Research Academic Staff, Research Chairs or Research Fellows, an academic specialist and several conjoint appointments with local institute partners.**
- **Our research groups are currently supported by diverse funding streams, including NH&MRC and ARC grants, grants from the US National Institutes of Health, US Department of Defence, US Juvenile Diabetes Research Foundation as well as major grants from charitable foundations and/ or through industry partnerships.**

Our research is organised into several major themes:

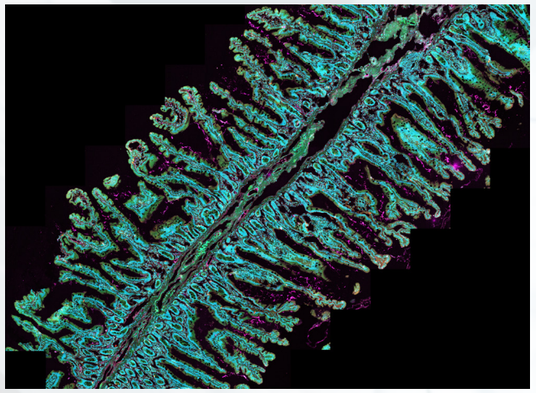
1. Neurosciences

The Department has a strong focus on the areas of sensory and autonomic neuroscience, and in the processes involved in the neural development and injury/ repair. Researchers employ a diverse range of cutting-edge technologies, including high resolution microscopy, advanced molecular physiology, human brain imaging and modern day 'omics' to understand nervous system function in health and dysfunction in disease.

Our Passion is Neuroscience, Cell Biology and Anatomical Sciences

Researchers within Department lead the world in research on the Autonomic and Sensory Nervous Systems, especially, in understanding the control of the digestive, urogenital and respiratory systems in health and disease as well as the neural organization of the retina and the inflammatory processes involved in degenerative conditions. Nine research groups within the Department focus on the fundamental principles of how the autonomic and sensory nervous system function using animal models and humans, and then use this information to evaluate disease mechanisms and potential treatments. As examples, researchers are evaluating novel treatments for gastrointestinal diseases, neural dysfunction underlying respiratory conditions as well as the main causes of vision impairment include retinopathy of prematurity, diabetic retinopathy and age-related macular degeneration.

In the area of Development, Injury & Repair of Neural Circuits, the Department has five research groups who focus on how the nervous system develops in the embryo and how the more mature nervous system and its support cells (glia) can be changed by experience, injury and disease. For example, our researchers have used innovative in vivo methods to evaluate the dynamic changes that occur in neurons during early embryonic development of the enteric nervous system (nerves important for regulating gastrointestinal function), studies instrumental in developing a stem cell approach that has potential to restore function in those with Hirschprung's disease, a developmental disorder of gut motility. Our researchers also investigate the neurodevelopmental disorders of cognition and the role of glia in demyelinating diseases such as multiple sclerosis. Research in this theme has been enhanced with the recent addition of expertise in transcriptomics and neurogenetics.



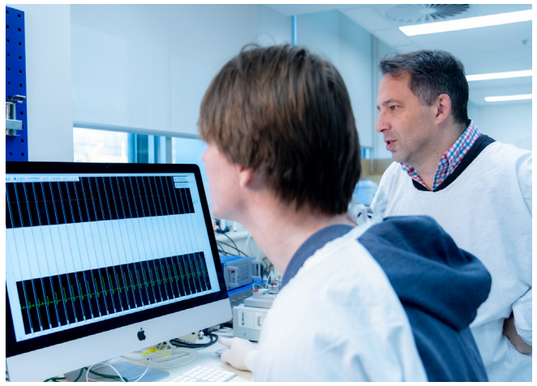
2. Cell and Developmental Biology

Nine research groups in the Department study a broad range of biological systems to answer fundamental questions about development and genetic processes at the organismal, cellular, and molecular level. Key research areas include: stem cell biology and genetics; reproductive biology, including the genetic basis of sex determination and gonad development; vascular development; growth factor signalling mechanisms in eye development; and developmental biology of the nervous system.

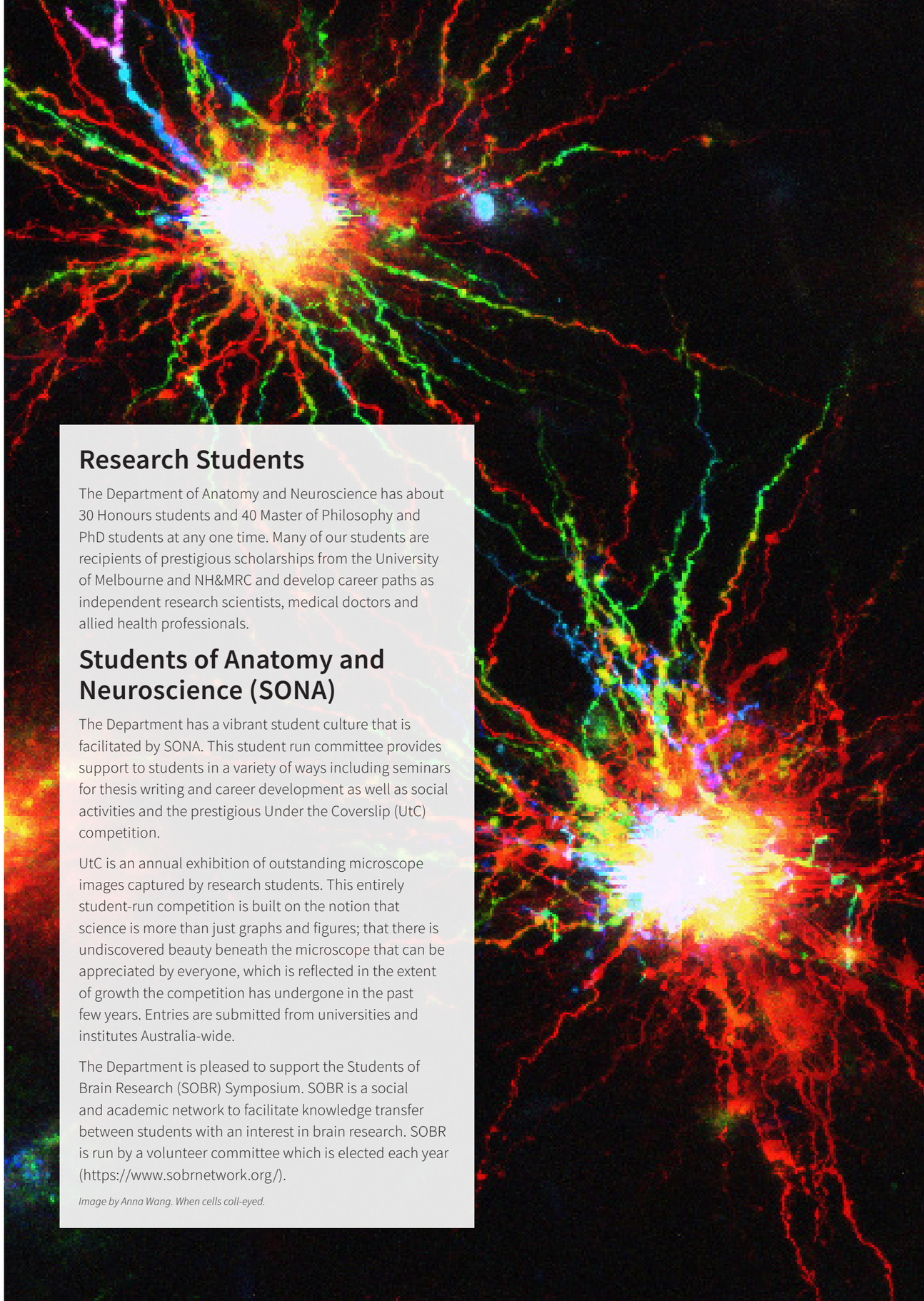
Efforts in this theme of research are strengthened by the establishment of the Department's Centre for Stem Cell Systems (headed by Professor Christine Wells) and the University of Melbourne led consortium Stem Cells Australia.

3. Anatomical Sciences

Many consider human topographic anatomy to be fully understood, despite much teaching being based largely on inherited knowledge and dogma. Whilst this may be acceptable at a basic level, advances in medical imaging and treatment have highlighted clear limitations in our understanding. Four research groups within the Department currently perform research in topographic anatomy. Anatomical Science research is critical for improving anaesthetic approaches to pain management and for developing an evidence-based approach for surgery. This research theme is evolving rapidly to become another flagship area in the Department.



SONA Committee – 2019
Casper Thorpe-Lowis (Vice President), Georga Bruechert (Liaison Officer), Anna Wang (President), George Stuyt (Secretary). Absent: Alexa Prawdiuk (Treasurer)



Research Students

The Department of Anatomy and Neuroscience has about 30 Honours students and 40 Master of Philosophy and PhD students at any one time. Many of our students are recipients of prestigious scholarships from the University of Melbourne and NH&MRC and develop career paths as independent research scientists, medical doctors and allied health professionals.

Students of Anatomy and Neuroscience (SONA)

The Department has a vibrant student culture that is facilitated by SONA. This student run committee provides support to students in a variety of ways including seminars for thesis writing and career development as well as social activities and the prestigious Under the Coverslip (UtC) competition.

UtC is an annual exhibition of outstanding microscope images captured by research students. This entirely student-run competition is built on the notion that science is more than just graphs and figures; that there is undiscovered beauty beneath the microscope that can be appreciated by everyone, which is reflected in the extent of growth the competition has undergone in the past few years. Entries are submitted from universities and institutes Australia-wide.

The Department is pleased to support the Students of Brain Research (SOBR) Symposium. SOBR is a social and academic network to facilitate knowledge transfer between students with an interest in brain research. SOBR is run by a volunteer committee which is elected each year (https://www.sobrnetwork.org/).

Image by Anna Wang. When cells coll-eyed.

Department of Anatomy and Neuroscience Staff and Students - 2019

Front row L-R:
Sarvy Taghavi, Kathleen Teng, Devy Deliyanti, Josephine Wong, Esther Ji, Yufang He, Charlotte Clark, Rex Barton-Smith, Erica Fletcher, Jennifer Wilkinson-Berka (Head of Department), Gary Hime (Deputy Head of Department), Peregrine Osborne, Brittany Homan, Louise Cheng, Patricia Gigliuto

2nd row L-R:
Stephanie Morgan Schlicht, Billie Lea Hunne, Alice Pebay, Pialuisa Quiriconi, Dayani Solomons, Vara Suphapimol, Nicole Weidmann, Michelle Rank, Georga Bruechert, Nicole Siddall, Franca Casagranda, John Furness, Marlene Hao, Alice McGovern, Michelle Gough

3rd row L-R:
Fatemeh Daemi, Muhammad Faiz Md Lukman, Renata Phyland, Rohan Long, Calvin Eiber, Dagmar Wilhelm, Matthew Trewella, Jennifer Keller, Cassie Doyle, Grace Lidgerwood, Gene Venables, Namrata Phan, Yvette Wilson, Lincon Stamp, Matthew Rutar

Back row L-R:
Michael Hew, Jenny Gunnersen, Linda Fothergill, Tony Wang, Ada Koo, Stefanie Dudczig, Una Greferath, Vanco Hristov, Aung Aung Moe, Joanna Phipps, Mitchell Ringuet, Amit Joglekar, Andrew Jobling, Abhirup Jayasimhan, Lesley Smith, Jack Bransfield, Sam Harris, Casper Thorp-Lowis, Ricardo De Paoli-Iseppi, Michael Dixon, Jack Jerome, James Brock, Michael Morgan, Ruslan Pustovit, Jarny Choi, Susie Kerby, John-Paul Fuller-Jackson, Kathy Avent, Mike Clark, Maciej Daniszewski, Joel Mason, Damian Hernandez, Ben Hogan, Gavan Mitchell and Robb de Iongh.

Absent:
Paul Angel, Annette Bergner, David Berka, Alice Brandli, Helen Braybrook, Tina Cardomone, Christine Wells, Jenny Gilbert, Nicole Dominado, Ophelia Ehrlich, Jessica Fletcher, Quentin Fogg, David Gonzalvez, Satya Gunnam, Jenny Hayes, Lauren Hill, Jason Ivanusic, Lerna Jurdukian, Kiana Kakavand, Janet Keast, Kellie King, Peter Kitchener, Vanta Jameson, Phil Marley, Joel Mason, Elizabeth Mason, Stuart Mazzone, Rosa McCarthy, Rachel McQuade, Victoria Morrison, Kathyn Munro, Megan Munsie, Simon Murray, Isha Nagpal, Aira Nuguid, Christ Pacheco Rivera, Varsha Pilbrow, Ger Post, Louise Rooney, Camille Shanahan, Martin Stebbing, Claire Tanner, Ian Taylor, Jenny Thai, Caitlin Van Ree, Kirstan Vessey, Christine Wells, Agnes Wong, Rhiannon Wood

We are home to 21 laboratories led by Senior, Mid and Early Career Researchers

Photo by Pierre Acobas on Unsplash

Our Research Leadership

Professor Jennifer Wilkinson-Berka

Retinal vascular biology and inflammation
Jennifer was appointed Head of the Department in May 2019. Jennifer's laboratory focuses on the contribution of vasoactive factors, oxidative stress and the innate and adaptive immune system to vision-threatening blood vessel damage in the retina. Studies are performed in animal models of retinopathy of prematurity, the major cause of vision loss in children, as well as diabetic retinopathy. These studies include (i) dietary and pharmacological interventions to modulate the immune system including the abundance of regulatory T cells and (ii) evaluating interactions between angiotensin II, aldosterone, oxidative stress and the immune system. The research is possible through collaborations with leading national and international scientists and clinician-scientists, and is supported by the NH&MRC, Diabetes Australia, The CASS Foundation and the US Juvenile Diabetes Research Foundation as well as industry partners.

Professor Gary Hime

Stem cell genetics and Drosophila models of human disease
Gary is Deputy Head of the Department. He entered the field of reproductive biology as a CJ Martin Fellow at Stanford University where he studied the genetic regulation of spermatogenesis in the laboratory of Professor Margaret Fuller, Department of Developmental Biology. Upon his return to Australia he set up the first Drosophila facility in an Australian medical research institute with Prof. David Bowtell at the Peter MacCallum Cancer Institute. He utilised the genetic tools available in Drosophila to dissect oncogene function. In the Department he has continued to use Drosophila and mouse models to study the genetic regulation of stem cells and model human disease. His laboratory is currently focussing on transcription factors and RNA binding proteins that regulate maintenance and differentiation of epithelial stem cells.

Associate Professor Robb de Iongh

Ocular development laboratory
Robb is the Deputy Head Teaching & Learning in the Department. He completed his undergraduate and PhD studies at the University of Sydney and studied at the l'Institut d'Embryologie in Paris and the Whittier Institute, La Jolla USA. His post-doctoral studies were conducted at the Save Sight Eye Institute, Sydney. His research is directed at understanding cellular and molecular mechanisms involved in ocular development and pathology, including retinal degeneration and cataract. A particular emphasis is understanding how growth factor signalling pathways regulates cell behaviours to control tissue structure and function and how these are subverted in disease processes. Recent studies have been directed at elucidating mechanisms of photoreceptor cell death in retinopathies and molecular mechanisms that affect neuronal plasticity following the loss of photoreceptors. Collaborative projects have focused on RNA binding proteins (TOB, ESRP1) during germ and somatic cell differentiation, the effects of particulate pollution on placental cells and on ciliopathies in syndromes affecting the respiratory system and vision.

Professor Stuart Mazzone

Respiratory Sensory Neuroscience
Stuart completed doctoral training at the University of Tasmania and spent the first 14 years of his career as an NH&MRC Research Fellow. During this time, he completed postdoctoral research training at the Johns Hopkins Medical Institutions in Baltimore (USA) and later established laboratories at the Howard Florey Institute and University of Queensland. In 2016 he joined the Department and is currently Deputy Head of Research and Chair of the Research Committee in the Department. Stuart's laboratory is internationally recognised for their work in the field of cough and respiratory sensation. In the respiratory system, sensory neurons are critical for the control of breathing as well as protecting against potentially damaging stimuli that could adversely affect ventilation. Excessive coughing and abnormal respiratory sensations are characteristic of many lung diseases but are difficult to treat with current therapies. Stuart's team utilise a diverse range of molecular, cell, animal and human experiments with the aim of understanding the neurobiology of these processes and enable rational therapeutic strategies to be developed for treating patients with lung disease.

Professor Erica Fletcher

Visual Neuroscience
For more than 18 years Erica's laboratory has focused on understanding the mechanisms leading to vision loss in Age Related Macular Degeneration. Her qualifications include degrees in Optometry and a PhD in neuroscience. She received a CJ Martin Award from the NH&MRC to undertake post-doctoral training with Prof. Dr. Heinz Wässle, at the Max-Planck Institute for Brain Research in Frankfurt, Germany. Since joining The University of Melbourne in 2000, her laboratory has accumulated experience with various technologies in retinal cell biology, including high resolution immunocytochemistry, electron microscopy, molecular biology, and retinal electrophysiology. In addition, her group are undertaking research involving animal models of retinal disease. Current projects focus on understanding the mechanisms underlying the changes that occur in retinal disease. Erica's laboratory was a contributor to the Australian government funded consortium tasked with developing an electronic retinal implant, that has been implanted in three individuals. In 2016 she was awarded the Glenn Fry Award from the American Academy of Optometry and in 2019 the H Barry Colin Research Medal from Optometry Australia.

Professor Christine Wells

Stem Cell Systems
Christine is an ARC Future Fellow in Systems Genomics, Chair of Stem Cell Systems, Director of the Centre for Stem Cell Systems at the University of Melbourne, and Deputy Program Lead of Stem Cells Australia. She is the architect of the Stemformatics platform, an international resource for sharing stem cell data. She discovered a role for the C-type lectin Mincle in macrophage responses to fungal and mycobacterial pathogens, as well as describing a role for Mincle in neuroinflammation. The laboratory uses pluripotent stem cells to develop new models of macrophage biology, so forming a better understanding of how these important cells of the innate immune system impact on tissue injury, infection and repair. The laboratory uses a combination of data-driven systems biology to computationally model macrophage behaviours from different tissues of the body, single cell transcriptomics to map the heterogeneity of cellular responses to activating stimuli, and laboratory stem cell models, including synthetic biology methodologies to direct new myeloid programs of behaviour. The tools and methodologies developed by the Wells laboratory are a significant national resource, with international uptake through consortia such as FANTOM, the Human Cell Atlas and Leukomics.

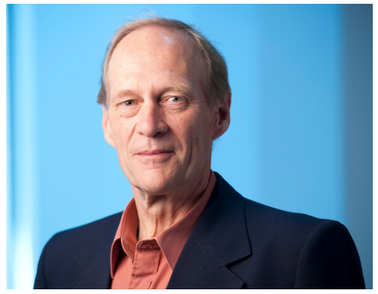
Associate Professor Jason Ivanusic

Pain and sensory mechanisms
Jason leads the Pain and Sensory Mechanisms Laboratory. His research focuses on understanding the molecular and physiological mechanisms that contribute to pain derived from skeletal tissues, or of trigeminal origin, with a view to identifying targeted ways to treat it. He enjoys overcoming the significant challenges that arise when working with skeletal tissues. Jason heads the only group in the world that is currently using electrophysiology to record directly from sensory neurons that innervate the bone marrow cavity. He is also actively engaged in a collaborative program of work that explores mechanisms of pain management using ultrasound-guided nerve blocks, and which directly informs clinical practice in anaesthesia. When he's not in or around the laboratory, he spends a lot of his time sharing his passion for teaching anatomy with medical, physiotherapy, biomedicine and science students, and has engaged in scholarly activity relating to this teaching interest through publication of innovations and internationalisation in his teaching activities.

Professor Janet Keast and Dr Peregrine Osborne

Neural development, injury and pain
Our research seeks to understand how the nervous system regulates pelvic organ functions such as voiding, continence and reproduction. In healthy adults, this requires precise coordination and integration of neural activity in the brain, spinal cord and visceral nerves. Elements of these circuits are compromised in clinical conditions, including pelvic pain. We study the development, anatomy and function of these circuits, using advanced imaging and neuroanatomical techniques to define microscopic and mesoscopic neural connectivity, in rodent models and human tissues. We are also expert in primary cell culture, cellular neurophysiology and neuropharmacology. Our current research is strongly directed to bioelectronic medicine, i.e., using implanted devices (instead of drugs) to control clinical conditions. To develop function-specific miniaturised implants that control organ dysfunction, it is essential to first generate a precise map of neural pathways, their connections with the organs and the spinal cord. We are directing this research towards translation in collaboration with colleagues at the Bionics Institute. Our research is supported by the National Institutes of Health SPARC common fund program and previously by the NIH-funded GenitoUrinary Development Molecular Anatomy Project database (GUDMAP).

Professor John Furness



Digestive physiology and nutrition
John is one of the most highly cited Australian scientists and has received many awards including Honorary membership of the British Physiological Society (2019). He is best known for his work in unravelling the intrinsic circuits of the enteric nervous system, for the chemical coding hypothesis, and for the discovery and identification of sensory neurons intrinsic to the digestive tract. The current emphases of his work are on (i) the relationships between diet, environment and gut health, and their implications for animal production and for human well-being; (ii) the influence on gut function of neuromodulatory therapies and their applicability to treatment of inflammatory bowel disease and gastroparesis; and (iii) the complexities of co-storage of gut endocrine hormones. He has worked closely with the pharmaceutical, medical devices and animal production industries. The laboratory is working to develop new approaches to treating bowel diseases through electroceuticals, in which nerves are stimulated to treat disordered function, through drug development and by unravelling the basic mechanisms essential for digestive health. The laboratory is also working to understand the reasons why gastrointestinal functions become disordered when there are pathologies of the central nervous system, such as in Parkinson's Disease. A major effort is in understanding the roles of gut hormones in diabetes.

Professor Ben Hogan

Genomics of development and disease
Ben completed his PhD at the Ludwig Institute for Cancer Research in 2005. He has been supported by fellowships from the Cancer Council Victoria, EMBO, NH&MRC and ARC. Ben's work has led to the discovery of a number of genes essential for angiogenesis and lymphangiogenesis, characterization of molecular mechanisms controlling the CCBE1/VEGFC/VEGFR3 signalling axis and description of new cellular processes involved in vessel formation in live tissues. In 2019, Ben relocated to the Peter MacCallum Cancer Centre and the Department of Anatomy and Neuroscience. Ben's group is investigating the development of lymphatic vasculature and the blood brain barrier, which play important roles in the metastatic spread of cancer and vascular disease. The laboratory uses zebrafish and mice as model systems to study fundamental processes in the developing embryo. The team are also using large-scale genetic and genomic approaches to discover new genes essential for development of the blood brain barrier. In addition, the laboratory is interested in developing imaging tools to visualise key cell signalling events in real time in vascular development and disease models.

Professor Megan Munsie

Ethical, legal and social implications of stem cell research
Megan is a stem cell biologist and champion of interdisciplinary research whose significant contribution to policy development and community engagement in stem cell science and regenerative medicine has been internationally recognised. Megan's employs empirical research to underpin the development of evidence-based engagement and public education initiatives, as well as inform national and international policy responses to key issues facing stem cell research and regenerative medicine. These interests include the experiences and views of Australians who have pursued or contemplated experimental stem cell treatments; healthcare professionals on stem cell interventions and non-evidence based practices; the development of ethical and regulatory frameworks to enable responsible translation of stem cell research discoveries to the clinic; assessing community expectation around emerging uses of stem cell technologies including modeling early human development, creating gametes and synthetic biology; and analysis of current regulatory and ethical frameworks pertaining to the creation and use of human embryos in light of recent scientific developments. The research is interdisciplinary and supported by academic, industry and community collaborators in Parkville and across the globe. The laboratory offers students and postdoctoral researchers a rich learning environment to explore the implications of stem cell research with a view to using research findings to inform policy development and community discourse.

Professor Alice Pebay

Stem Cell Disease Modelling

Alice's laboratory focuses on the study of human pluripotent stem cells for modelling neurodegenerative diseases. The difficulty in obtaining brain or ocular tissue from living people is a major barrier to developing new treatments for neurodegenerative disease. The laboratory can now generate stem cells from adult tissue, and these "induced pluripotent stem cells" (iPSCs) represent a powerful disease modelling tool. Generating iPSCs directly from patients allows cells to be differentiated into specific cells of interest for disease modelling, drug screening, and understanding of fundamental pathogenic mechanisms. The laboratory differentiate iPSCs into various cell types of the central nervous system to model age-related macular degeneration, glaucoma, inherited retinal dystrophies and optic neuropathies, in order to establish the molecular events leading to disease progression and aspects of neurodegeneration. We also use gene editing technology for correction of monogenic diseases of the retina and the optic nerve. CRISPR-based technology is being heralded as a relatively straightforward technology for in vitro correction of genetic mutations in patient-specific cells and is particularly attractive for treating inherited diseases caused by genes with very specific spatial and stoichiometric expression, such as those found in many of the monogenic diseases we study. We use our unique cohort of patients with distinct monogenic inherited retinal dystrophies and iPSC technology to directly study the utility of genomic editing and correction.

Dr Simon Murray

Neurotrophin and myelin

Simon graduated as a physiotherapist and worked clinically for several years before completing his PhD in 2000. He undertook postdoctoral training at New York University, the Walter and Eliza Hall Institute and the Florey Institute, before joining the Department in 2010. Simon's laboratory comprises over 10 research staff and students. His research aims to identify the nature of molecular and cellular signals that are vital for initiating, promoting and maintaining central and peripheral nervous system myelination during development and to develop novel neurotrophin-based therapeutic strategies for promoting myelin repair in demyelinating diseases such as multiple sclerosis and other neurodegenerative diseases where demyelination is a primary or secondary pathology. The laboratory uses a variety of molecular, cellular, biochemical, genetic and confocal imaging techniques in combination with electrophysiological and behavioural analyses, to investigate these events.

Dr Louise Cheng

Stem cell and organ size control regulation

Louise is a member of the Peter MacCallum Cancer Centre and the Department of Anatomy and Neuroscience. Louise's laboratory uses the fruit fly Drosophila to study how organ size is maintained and how metabolism can shape organ growth. The laboratory is interested in a number of questions:

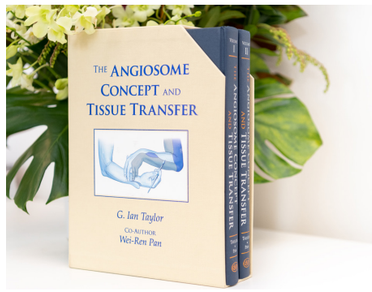
* How differentiation is maintained in the developing nervous system
* How the niche surrounding the neural stem cells affect stem cell behaviour
* How one specialized cell type in the CNS can become another through trans-differentiation
* How regeneration is regulated in the CNSs of flies and zebrafish
* How tumours breakdown fat and muscles during cachexia
* How organs communicate with each other to maintain tissue homeostasis.

Associate Professor Quentin Fogg

Surgical Anatomy Laboratory

Quentin is a clinical anatomist with broad interests across the research, teaching and interpretation of anatomy in a way that is meaningful to the care of patients. The Fogg Lab uses micro-dissection, microscribe digitisation, medical imaging and histology to provide anatomical answers to clinical problems. These answers are visualised using a combination of high-resolution photography and videography, digital modelling, and illustration (digital and ink), enriching research outputs and teaching resources. The main anatomical areas of interest are human hands and feet, although the laboratory regularly applies its suite of techniques to other areas of the body. Quentin teaches advanced head-to-toe anatomy for a range of student groups and specialises in the design and delivery of short courses for clinicians, which he has delivered internationally. In 2013 his work in clinical anatomy was recognised by election to Fellowship of the Royal College of Physicians and Surgeons of Glasgow. Quentin also regularly collaborates with artists to explore the art:anatomy interface and how we interpret our bodies, their study and broader applications of contemporary anatomical work.

Professor Ian Taylor AO



Jack Brockhoff Reconstructive Plastic Surgery Research Unit
Ian's research commenced in 1972 in the Anatomical dissection room at the Royal Melbourne Hospital in response to a patient facing amputation of his severely injured leg that culminated in the first microsurgical transfer of a skin flap – named the Free Flap. What followed was a clinical series of free vascularised bone, nerve and then tendon flap transfers all based on fresh cadaver dissections to define not only the arterial and venous anatomy of the transplant but the vasculature of the recipient site. This resulted in a mapping of the neurovascular and lymphatic anatomy of the entire body, summarized in the two-volume text entitled "The Angiosome Concept and Tissue Transfer". This has revolutionised the management of patients with congenital or acquired tissue defects, especially following trauma or ablative cancer surgery and the management of conditions such as lymphoedma, tissue necrosis and ulceration. Previously, especially during the two great wars, reconstruction of injuries required multiple operations staged over months, sometimes years. Now a superior result, including all elements of skin, muscle and bone, can be achieved in one operation. We can include sensation to skin flaps and mobility to transferred muscles thereby restoring patient quality of life. The research, in the main, is supervised by honorary surgeons, frequently involving the trainee in the operating theatre to witness the application of their research. These surgeons include: Russell Corlett, Mark Ashton, Martin Richardson, Ian Jones and Ramin Shayan. In the future, we will continue to supply solutions to traumatic, congenital or acquired defects and will extend these investigations to the use of Vascularised Composite Allografts.
We have supervised numerous students and our work has been recognised nationally and internationally and the University of Melbourne and Royal Melbourne Hospital are currently the World's top Reconstructive Plastic Surgery Research Institutes.

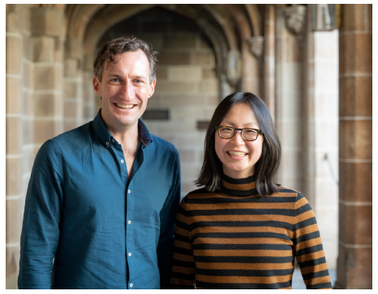
Dr Dagmar Wilhelm

Sex determination and disorders of sex development
Dagmar is a vertebrate developmental biologist with a background in molecular biology and cancer research, known internationally for her work on sex determination. Using mouse as a model system, the ultimate goal of her research is to understand the genetics of sex determination, gonad development, and reproduction, and how failure results in human disorders/differences of sex development and infertility. During her career, Dagmar has received training in a wide range of technologies, giving her the unique opportunity to integrate cell, molecular and developmental biology, biochemistry, mouse genetics and proteomics to achieve her goals. She has made seminal contributions to the field including the identification of the first in vivo targets of WT1 and SRY, the elucidation of a new back-up mechanism to ensure testis differentiation, and the role of miRNAs in testis differentiation. In recent years, she focused her research more on ovarian development and function. Current projects include the influence of diet on ovarian development, the characterization of a new model of premature ovarian failure, and the analysis of a novel factor involved in male infertility.

Dr Jenny Gunnersen

Neuron development and plasticity
Jenny leads a research team of 10 staff and students investigating the development and plasticity of neuronal circuits and the pathological bases of developmental and neurodegenerative disorders. In her first post-doctoral position, she worked with Michael Sendtner in Würzburg, Germany investigating trophic factors for motoneuron survival and regeneration. Jenny returned to Melbourne to work with Seong-Seng Tan in the Brain Development Group at the Howard Florey Institute and held an NH&MRC Howard Florey Centenary Post-doctoral Research Fellowship, a Neurosciences Victoria / Centre for Neuroscience Fellowship and a Senior Research Fellow position. During this period, Jenny utilized emerging gene expression profiling techniques to obtain the first molecular inventory of the developing cortex and created gene knockout mouse models to determine functional roles for some of the novel genes identified. In 2011, Jenny moved to the Department. Her work is focussed on: (i) molecular and cellular mechanisms controlling synapse development; (ii) synapse loss in the earliest stages of Alzheimer's disease and how this might be slowed or prevented; (iii) synapse formation/strengthening and how these processes contribute to the pathology of psychostimulant abuse and neuropathic pain.

Dr Lincon Stamp and Dr Marlene Hao



Development of the enteric nervous system
Proper development and function of the digestive tract is crucial for good health. Gastrointestinal function relies on the co-ordinated activity of neural circuits in the enteric nervous system, a network of neurons and glia located within the wall of the gut. During development, enteric neurons arise from neural crest cells that emigrate from the caudal hindbrain and migrate into and along the developing gut. Enteric neural crest cells are thought to migrate further than any other embryonic cell population. Our research is focused on the mechanisms controlling the development of the enteric nervous system and the potential of cell therapy for treating diseases of the enteric nervous system.

Dr Mike Clark

Transcriptomics and Neurogenetics
Mike works at the intersection of genomics and neuroscience, utilising a number of transcriptomic (RNA-Seq, Nanopore long-read sequencing, targeted RNA sequencing and single cell sequencing) and functional genomic approaches to investigate gene expression and function in the human brain and in neuropsychiatric disorders. The laboratory has two main areas of investigation. (i) Characterising risk genes for neuropsychiatric disorders. Many regions in our DNA confer risk to disease, including schizophrenia and bipolar disorder, but the genes responsible and how they confer risk are often unknown. We are interested in identifying these genes, both protein coding and noncoding (i.e.: long noncoding RNAs) and how their expression can change to cause disease risk. We utilise both post-mortem human brain and neurons derived from induced pluripotent stem cells to help answer these questions. (ii) Novel applications of Nanopore sequencing. We are focused on utilising Nanopore sequencing, a technology that can sequence both DNA and native RNA. We are applying Nanopore sequencing to address questions in diverse fields including neuroscience, cancer and marsupial genomics, as well as developing novel applications for this technology.

Dr Matthew Rutar

Ocular neuroimmunology
Matthew's laboratory explores the immunological landscape of the nervous system, with an emphasis on the eye as a model system for understanding innate immunity and macrophage biology in health and disease. Our long-term goal is to uncover new insight into how macrophages shape inflammation at the neuroimmune interface, and in ways that could simultaneously lead to improved therapeutics for vision disorders such as age-related macular degeneration (AMD). We employ a multidisciplinary toolkit which leverages sophisticated molecular profiling approaches, imaging platforms, animal models of retinal disease, and stem cell technologies. These have focussed primarily on the exploration of AMD, though the laboratory has an emerging interest in the molecular mechanisms that govern inflammation in other conditions including uveitis. Current projects include (i) The role of the complement cascade in AMD and uveitis, (ii) Identifying gene networks that direct inflammation in macrophage subsets using single-cell RNAseq, and (iii) Modelling microglia-neuron immune interaction in vitro using induced pluripotent stem cell.

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