MONASH University

BIOMEDICAL SCIENCE STUDY AREAS

monash.edu/discovery-institute

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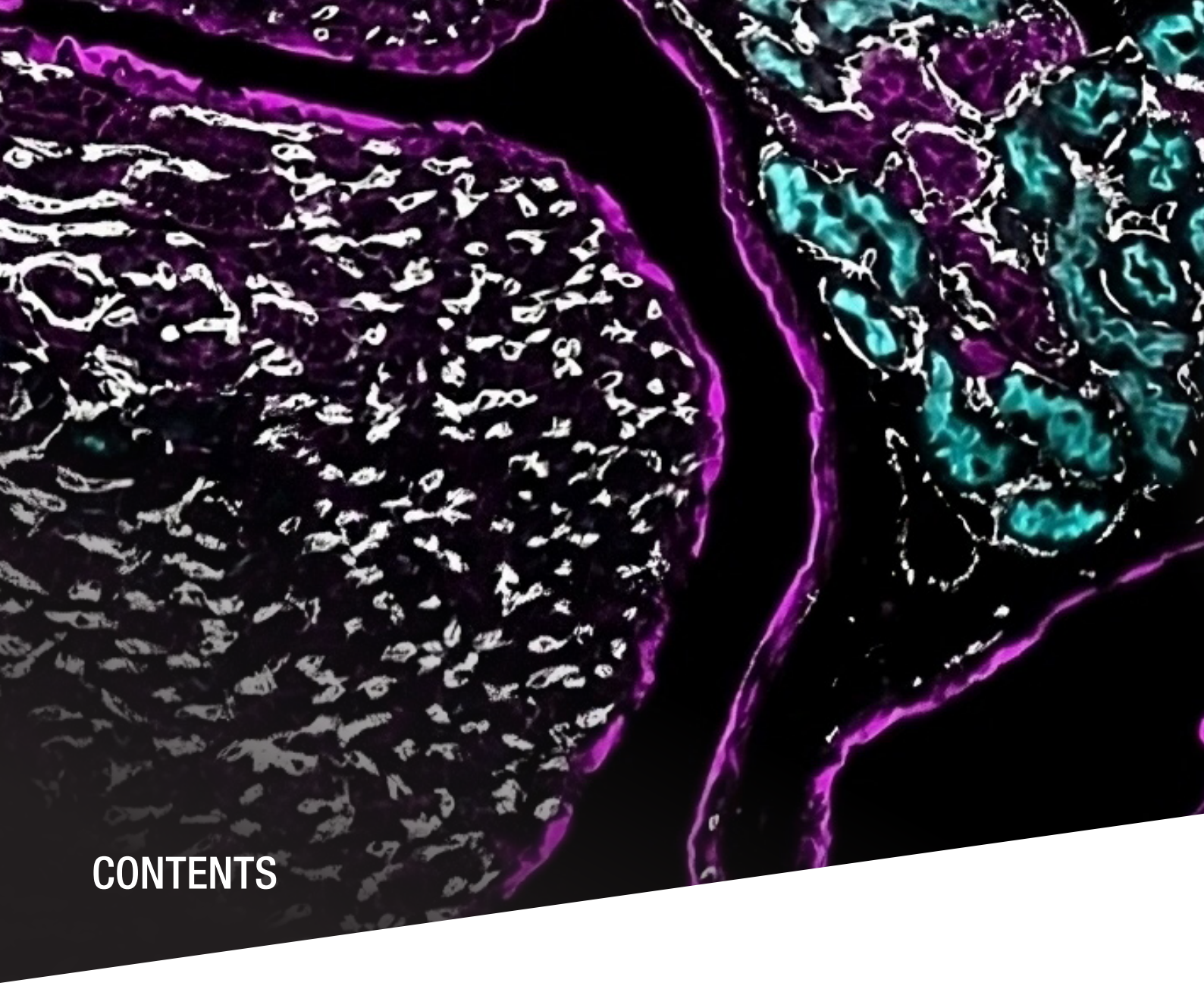

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*All images in this booklet were supplied courtesy of Monash Micro Imaging

Bunjil: Embryonic Kidney section showing tubules (cyan), ureteric epithelium (magenta) and smooth muscle cells (grey).

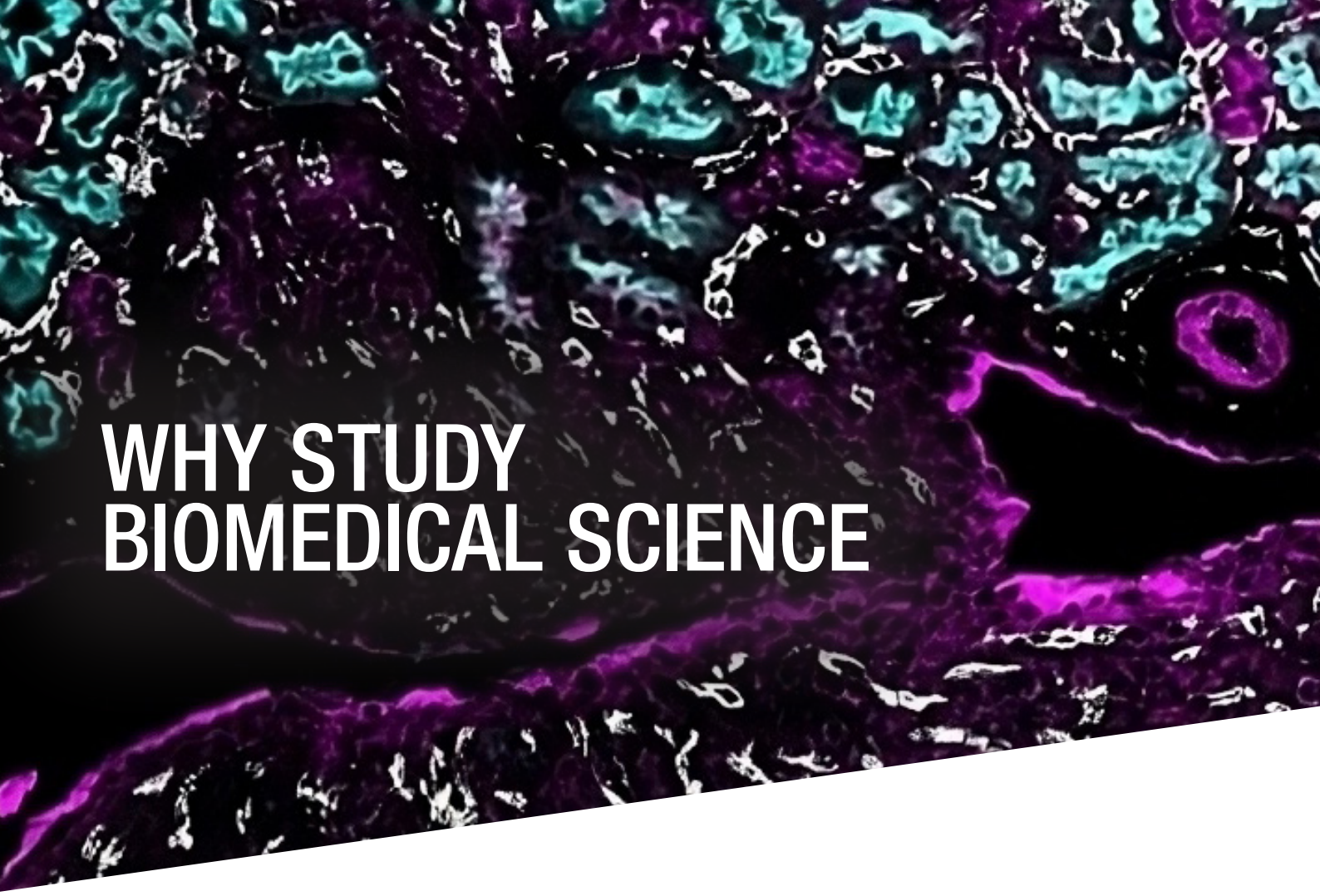
Julie Moreau, Dept Anatomy and Developmental Biology, Biomedicine Discovery Institute, Monash University, Clayton.

Acknowledgement

We acknowledge the traditional lands of Indigenous peoples.

The Faculty incorporates the Aboriginal and Torres Strait Islander Curriculum Framework in educating future health professionals. You will learn skills in respect, communication, safety and quality, advocacy and reflection to improve Indigenous health.

Monash is committed to facilitating the entry of Indigenous students into courses. There are a range of pathways, entry points, bursaries, scholarships, accommodation, tutorial support and cadetships. To learn more about entry requirements and our Indigenous Access Interview, contact Gukwonderuk Indigenous Health staff via email at med.indigenoushealth@monash.edu or 03 9905 3828.



WHY STUDY BIOMEDICAL SCIENCE

Interested in using science to make a difference to human health? Studying biomedical science equips you with the knowledge and skills to tackle today's most critical issues in healthcare and disease.

WHAT IS BIOMEDICAL SCIENCE?

Biomedical science is the study of organs, tissues and cells, as well as the complex processes that occur to allow humans to function and develop normally. During your degree you will learn how disruption of these processes can lead to disease, and you'll gain an understanding of how this knowledge fits into the big picture of human health.

HOW CAN I STUDY BIOMEDICAL SCIENCE?

There are three ways you can study biomedical science at Monash:

BACHELOR OF BIOMEDICAL SCIENCE

In this course you'll begin studies in biomedical science from day one. This includes a range of biomedical units that explore all areas of human health and disease. There are 14 core subjects that are all interconnected and form a solid foundation for your future career.

BACHELOR OF SCIENCE

You can specialise from second year to focus on one or two biomedical science areas. This degree will let you choose a major area of study and graduate with in depth expertise in that field.

DOUBLE DEGREES

The Bachelor of Biomedical Science can be combined as a double degree with:

- Commerce
- Engineering(Honours)
- Law (Honours)
- Science

For more information about courses at Monash - visit find a course **https://www.monash.edu/study.**

WHAT ARE MY CAREER POSSIBILITIES?

You'll develop the skills and knowledge that will help you to make a difference to human health through a wide range of career paths. When you finish your undergraduate course, some of the options available to you include entering the workforce through a graduate job, progressing to a research-based Honours year or completing postgraduate study that will qualify you for a health profession.

Career opportunities that biomedical science graduates can pursue include (but are not limited to):

- Bioinformatician
- Biotechnologist
- Clinical researcher
- Clinical trials manager
- Educator
- Food scientist
- Forensic scientist
- Pharmaceutical sales and marketing
- Public health advisor
- Reproductive scientist
- Researcher
- Science writer
- Strategy consultant

Biomedical science at Monash also gives you great preparation for graduate medicine and future careers in medical research.

GRADUATE MEDICINE

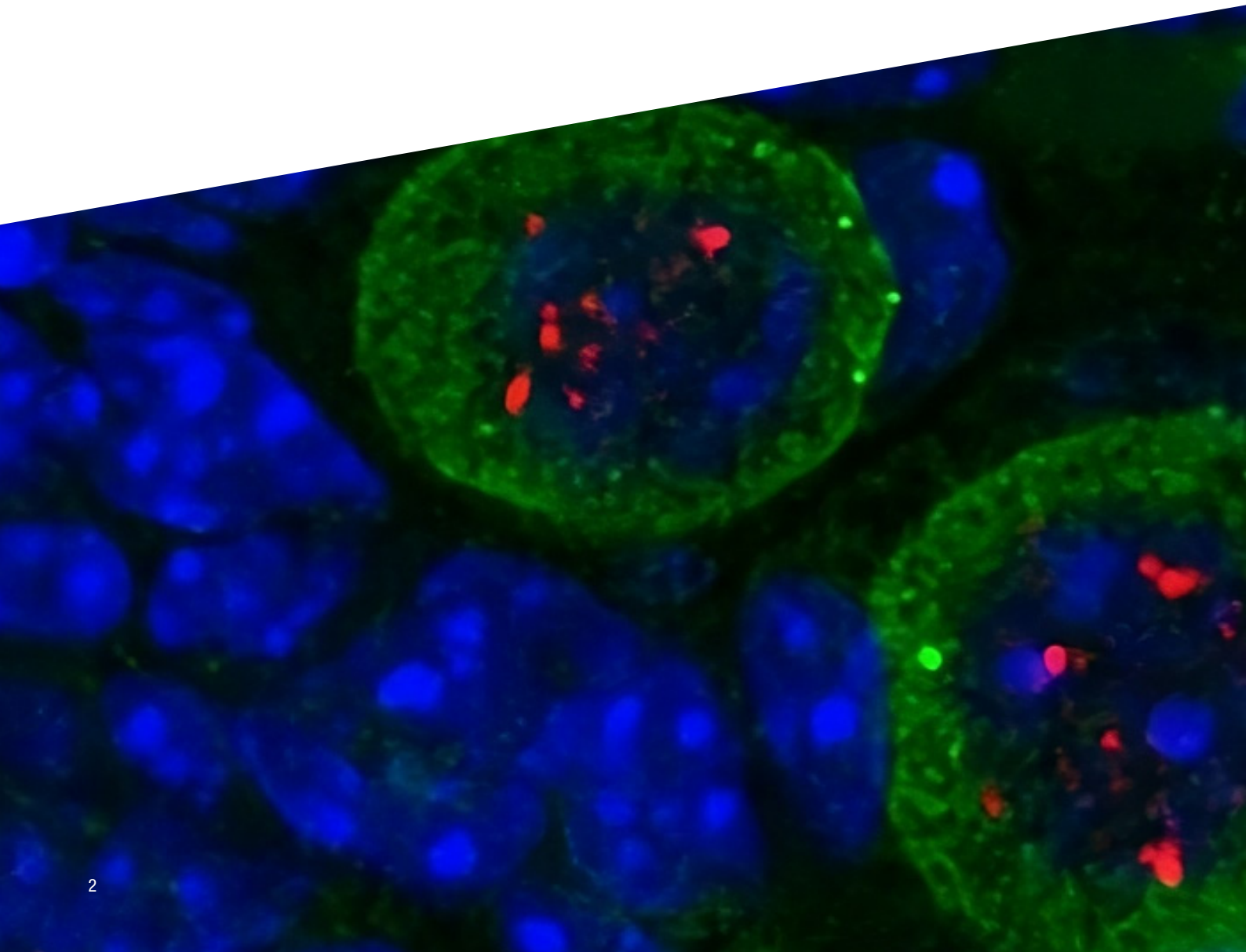
When you complete the Monash Bachelor of Biomedical Science, Bachelor of Science (with specified subjects completed) or double degrees you will be eligible for up to 75 places within the Graduate Entry Doctor of Medicine course.

For more information, please visit **https://www.monash.edu/study/courses/find-a-course/medical-science-and-medicine-m6018**

BIOMEDICAL SCIENCE
AREAS OF STUDY

Biomedical science is taught through the Faculty of Medicine, Nursing and Health Sciences, across the Monash Biomedicine Discovery Institute and the Central Clinical School.

Biomedical science is an interdisciplinary field that combines biology and medicine in order to understand and improve the health of humans. The biomedical science areas of study examine how the body works in health and in disease, and will be the key to advances in medical treatments and human health in this century.



AREAS OF STUDY IN BIOMEDICAL SCIENCE

ANATOMY AND DEVELOPMENTAL BIOLOGY

BIOCHEMISTRY

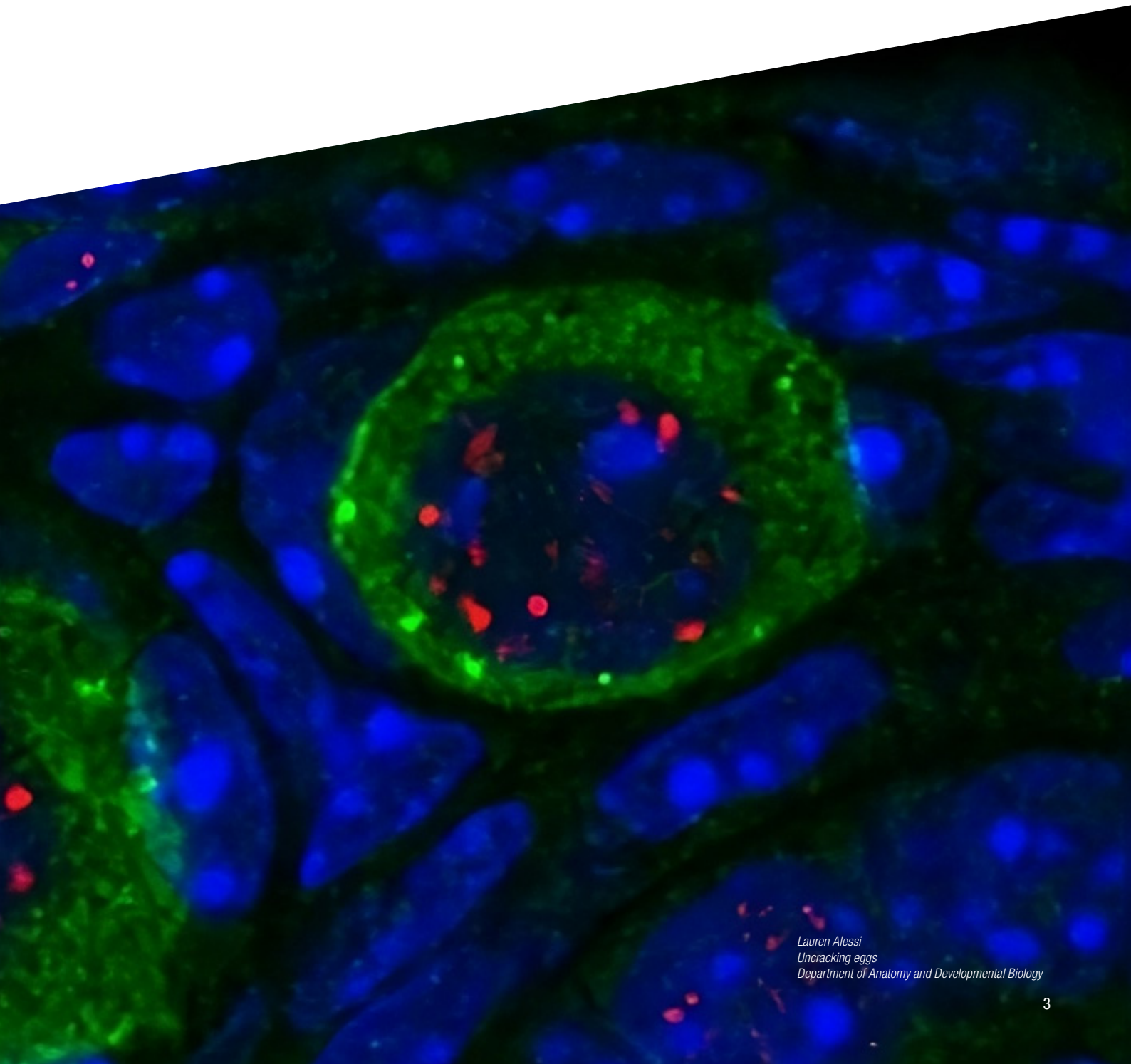
HUMAN PATHOLOGY

IMMUNOLOGY

MICROBIOLOGY

PHARMACOLOGY

PHYSIOLOGY



Lauren Alessi
Uncracking eggs
Department of Anatomy and Developmental Biology

ANATOMY AND DEVELOPMENTAL BIOLOGY

Anatomy and Developmental Biology delves into the fascinating journey of how a single cell transforms into a complex organism. You'll explore the intricate processes of embryonic development, from fertilisation to birth, while gaining a deep understanding of human anatomy and its connection to health and disease.

Why should I study anatomy and developmental biology?

Dive into the fascinating world of Anatomy & Developmental Biology and unveil the blueprint of life itself! This major equips you to explore the awe-inspiring transformation of a single cell into a complex organism. You'll gain a deep understanding of human anatomy and how it shapes our health, preparing you for a rewarding career in cutting-edge fields like tissue engineering and stem cell research. Become a future leader in biomedicine – start your journey today!

What will I learn about?

- Early human development & organ formation
- Anatomical foundations of health & disease
- Stem cell biology & its role in life
- Human anatomy terminology & structure
- Explore specific body systems in depth
- Evolution and development

Where will anatomy and developmental biology take me?

This dynamic field equips you to tackle healthcare's biggest challenges. Unravel causes of disease and the impact of the environment on health through the lifespan, and develop new approaches to treatment as a biomedical researcher, or use your knowledge to help couples build families as an IVF scientist. You may even like to become a bioengineer creating life-changing prosthetics, learn how to develop complex human stem cell tissue models and therapies, become an educator in the field teaching tomorrow's scientists, or lay the foundation for post graduate clinical study with a deep understanding of the human body. Imagine studying the very structures you'll one day diagnose and treat! Anatomy & Developmental Biology is your launchpad to a fulfilling career making a real difference.

Before coming to university, I had actually never heard of developmental biology before. I decided to take a unit as an elective and I loved it so much that I changed my course map and pursued it as a major!

Learning about the complex pathways and steps that occur to allow a single cell to form a fully grown adult has been fascinating. What I like particulary is the wide variety of topics covered, from anatomy, to gene expression, to pathology and regeneration. The diversity of the content gives you the chance to explore lots of different areas and figure out what you like the most. There is something for everyone!

One of the key highlights has been the hands-on experience and lab classes. Being able to look at and interact with human specimens in the Centre of Human Anatomy Education has been an irreplaceable experience. I have learnt so much more by being able to see how the human body works in-person, than I would have if I had watched a video or lecture.

NAOMI KAH
Bachelor of Science
Area of study: Anatomy and Developmental Biology

Studying anatomy and developmental biology has greatly enhanced my knowledge and appreciation of the incredibly complex human body. Specifically, how it changes and grows over embryological development.

I have been fortunate enough to study animal models and understand the parallels and conservation in development between different species, which leads to a greater understanding of how the human body forms and how it functions.

There are many laboratory sessions taught by incredible academics, helping to solidify what is taught in the lectures; this is something I have thoroughly enjoyed at Monash. The labs are a critical part of this unit and most concepts taught in the lectures can be directly observed with anatomical models, dissection models - which makes this field highly interactive and hands-on.

The academics in this department are keen to provide support, further feedback and nurture you throughout the course, as well as provide advice as to how you can proceed in your academic journey to further study. Anatomy and Developmental biology is incredibly interesting and will contribute immensely to your learning of the human body.

LUCAS D'COSTA
Bachelor of Biomedical Science
Area of study: Anatomy and Developmental Biology

BIOCHEMISTRY

Biochemistry deals with the chemical components and genetic material of living cells, allowing us to understand the molecular events that underlie biological processes and determine the molecular and genetic abnormalities that cause human disease. Biochemistry draws on biology, chemistry and physics, providing a key interface between these fields. By understanding biological systems at the molecular level, biochemists are able to interpret the activities of living cells.

Why should I study biochemistry?

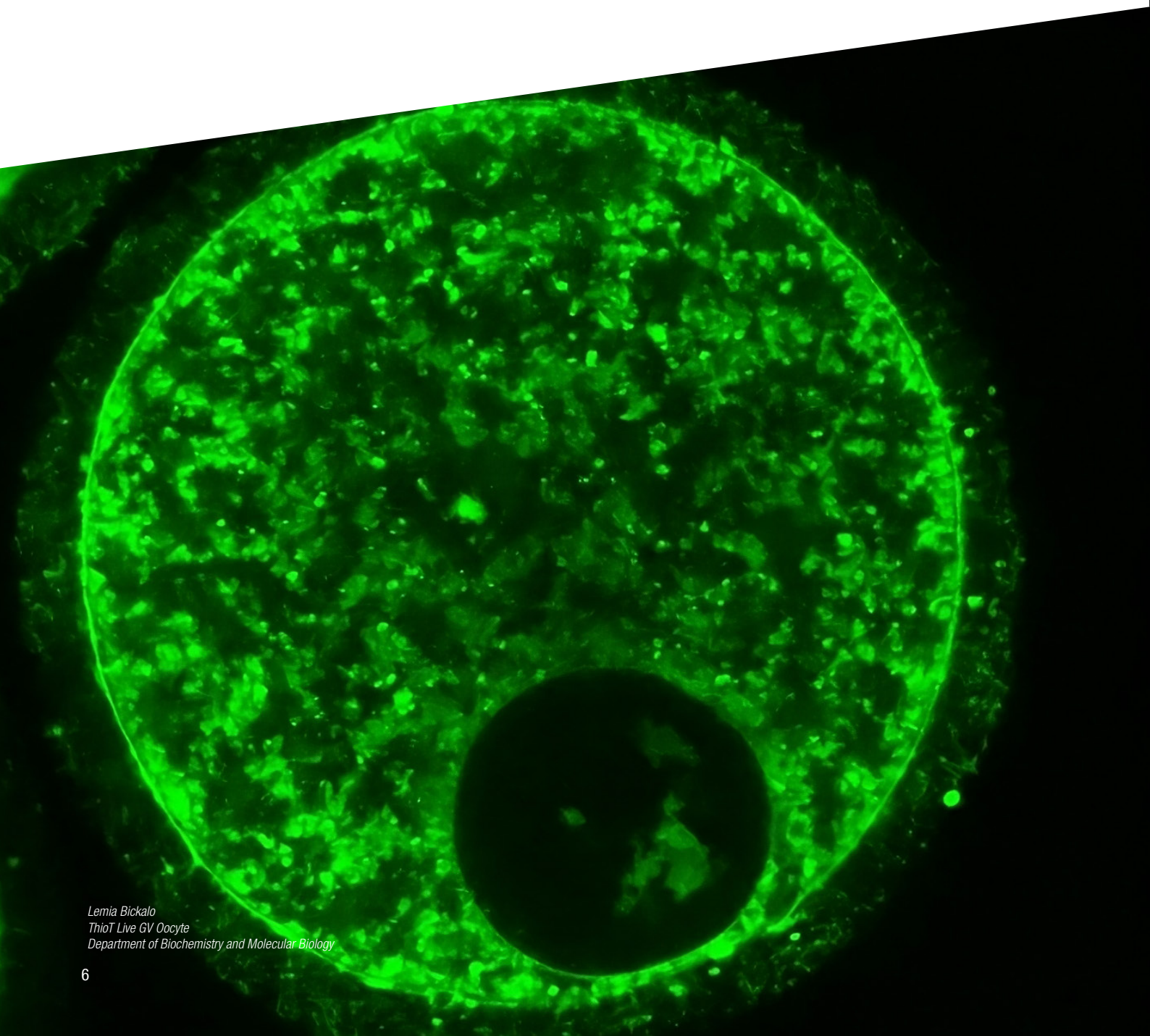
Biochemistry expands our understanding of the causes of disease and provides a basis for the development of effective treatments. Biochemical knowledge has many applications in research and technology, and is sought after in diverse fields, from forensic science to agriculture and plant biology.

What will I learn about?

- Structure and function of cellular biomolecules
- Genes and their expression, regulation technology and applications
- Metabolic basis of human diseases
- Cellular signal transduction and its role in cancer and disease
- Protein biology from sequence to structure and disease

Where will biochemistry take me?

A degree specialising in Biochemistry opens the doors to diverse careers including medicine, science and technology, health sciences, education, law, agriculture, the environment and more. It is essentially your passport to develop into a career of your choice!



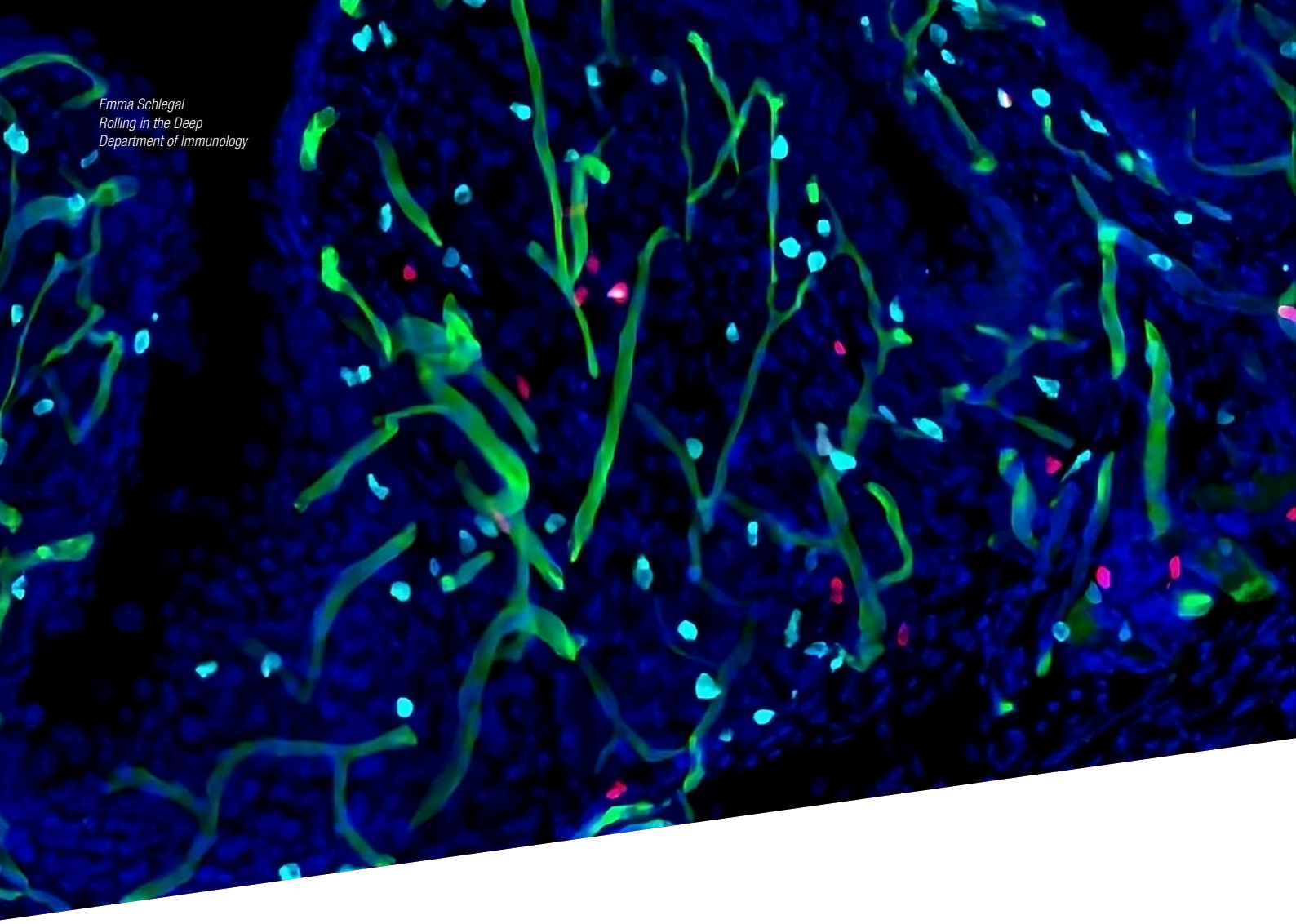
Lemia Bickalo
ThioT Live GV Oocyte
Department of Biochemistry and Molecular Biology

Biochemistry has helped me learn more about biology and chemistry on the molecular level, inside a cell. Having completed some core biomedical science subjects, I chose to complete additional biochemical studies because the concepts of gene therapy, protein engineering and mRNA therapeutics were very interesting. Innovations in these areas allow for treatment of many diseases.

The Research in Action unit allowed me to work on my own research project. An experience that gave me a lot of freedom to perform experiments myself but also much responsibility. I've developed strong technical skills, become more skilled at critically analysing scientific research papers and understanding how to interpret data. After completing numerous presentations, I've learnt how to present scientific concepts in an engaging and interesting way. Completing an undergraduate research unit has also allowed me to develop skills in project management.

Research in biochemistry isn't just about the lab work, there are opportunities to attend conferences, both domestic and international, and present your own research and interact with other scientists who are doing similar work.

LEMIA BICKALO
PhD
Area of study: Biochemistry



Emma Schlegal
Rolling in the Deep
Department of Immunology

HUMAN PATHOLOGY

Human pathology is the study of disease processes, including disorders of immunity and neoplasia, inflammation and cell death. This area of study examines how the body responds to disruption of normal tissue structure and function by injurious agents. You'll learn how the cause of a disease (such as a gene mutation or external injury) leads to cellular and tissue abnormalities, which result in clinical symptoms.

Why should I study human pathology?

The study of human pathology is fundamental for medical research or clinical and laboratory medicine. You'll develop a comprehensive understanding of how organ systems fail during disease and injury, which is critical for diagnosis, prognosis and therapeutic intervention. Human pathology involves examining disease in a multidisciplinary manner, giving you opportunities to apply your knowledge of other biomedical sciences, and to gain the basic tools of diagnosis of disease in a patient.

What will I learn about?

- Understanding disease processes
- Pathology of human diseases
- Clinical immunopathology
- Neuropathology
- Pathological processes such as necrosis, cell injury, ischaemia
- Causes and outcomes of disease

Where will Human Pathology take me?

A major in human pathology will allow you to develop skills (including logical reasoning, laboratory and communication skills) essential in a range of careers in science and biomedicine. These skills could be applied to a career in diagnostic medical laboratories or many biomedicine associated careers, including medical science liaisons, biosafety regulation, and public health/ government policy. Human pathology could also lead to a career in biomedical research with a focus on diseases having a significant global impact, such as diabetes and heart disease.

Human Pathology has enriched my studies in Immunology and helped me understand the context of diseases and their mechanisms. Through my major, I've taken my molecular and cellular knowledge and seen how these microprocesses impact the body on a macro scale. It helped me understand how histopathology is used in the diagnosis of disease and how to identify the outcomes and sequelae of conditions.

Much of the specific terminology used in the field was foreign to me when commencing pathology, especially when discussing specific types of tissue injury. However, by the end of my course I felt I could accurately describe different responses to sublethal injury- my favorite is caseous necrosis.

I've enjoyed working with students from different Science and Biomedical Science backgrounds to solve challenging pathology cases, learning about specific staining techniques and tissue characteristics and how their presence can be used to infer disease. It was wonderful to see so many specimens in detail, and appreciate their different, distinct morphologies.

CLAIRE DAVISON
Bachelor of Science (Hons)
Area of study: Human Pathology

I've always been fascinated by the mechanisms of diseases and how they manifest within the human body.

Through my human pathology studies, I've developed in-depth knowledge of the aetiology, pathogenesis, and systemic effects of various diseases, including cardiovascular disease, cancer, and immunodeficiency, along with the underlying immunological processes driving them.

The practical sessions have given me valuable and transferable skills, such as teamwork and problem-solving, while the friendly and supportive staff have enhanced my learning. I thoroughly enjoyed our laboratory sessions, where we learnt how to assess healthy and diseased histological slides. As well as this, I enjoyed understanding how diseases affect the body, as it has highlighted the clinical significance and real-world application of pathology, including the importance of identifying new processes and novel targets to improve patient outcomes.

This inspired me to want to pursue research, leading me to complete my honours year focusing on discovering the mechanisms driving therapeutic resistance in blood cancer.

BRIANNA OAKLEY
Bachelor of Science (Hons)
Area of study: Human Pathology

IMMUNOLOGY

Immunology is the study of the immune system in health and disease. The immune system is crucial for our survival, as it protects us from infectious diseases caused by bacteria, viruses, fungi or parasites. It is the reason why we recover from a cold but also why we suffer from allergies, have autoimmune diseases such as type I diabetes, and why we reject tissue transplants without medication.

Why should I study immunology?

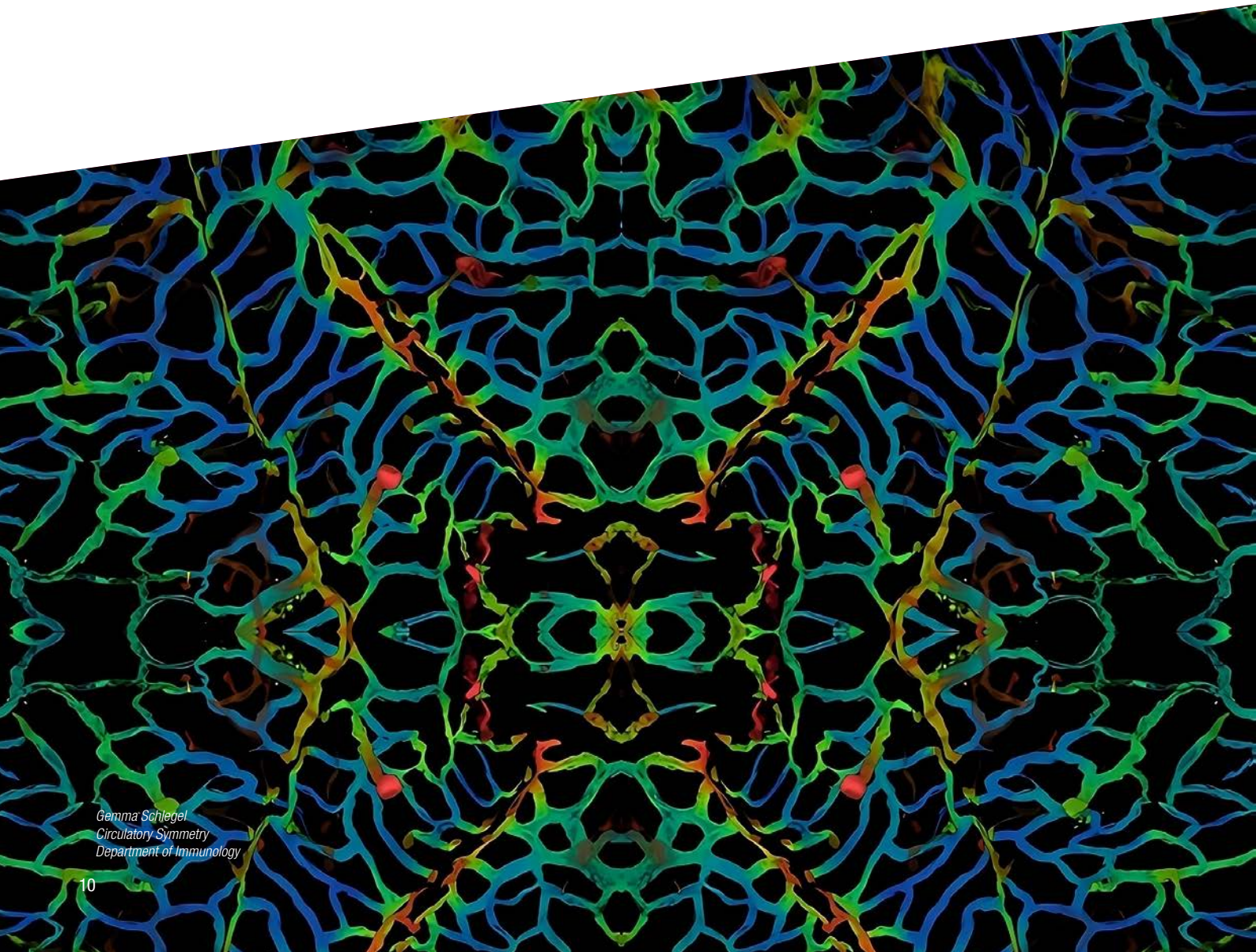
Immunology is the basis of many health issues in our society, including infectious diseases, cancer, allergies and autoimmunity. Knowledge of immunology enables progress in these areas. Choosing to study immunology will provide you with a foundation for understanding many aspects of human disease. There is emerging evidence that links immunity to areas of health such as diet, mental health and cardiovascular disease. It is a field filled with new and exciting discoveries and applications, such as investigating how we can manipulate the immune system to provide better health to individuals.

What will I learn about?

- Immunology in health and disease
- Molecular and cellular immunology
- Clinical immunopathology
- Principles of applied immunology
- Clinical and research laboratory immunology

Where will Immunology take me?

The field of immunology is constantly evolving; recent research has demonstrated important links between our gut microbiota and immunity, and potentially between the immune system and mental health. Immunological research has led to many revolutionary medical treatments, including immunotherapies to treat cancers, allergies, and autoimmune diseases, and the development of novel vaccines, such as for COVID-19. An immunology major allows you to develop multiple skills including critical thinking, communication and data literacy. These skills are applicable to many careers ranging from basic and clinical immunological research, to education, patent law, clinical trials, public health, and publishing.



Gemma Schlegel
Circulatory Symmetry
Department of Immunology

I have always been fascinated by the intricacies of the immune system and majoring in immunology allowed me to feed my curiosity through a large variety of topics.

Studying immunology has exposed me to a variety of career paths and real-world applications. The opportunity to do undergraduate research allowed me to develop the skills I need to be a passionate and successful biomedical researcher. The immunology teaching staff were supportive and their enthusiasm helped to cultivate my own.

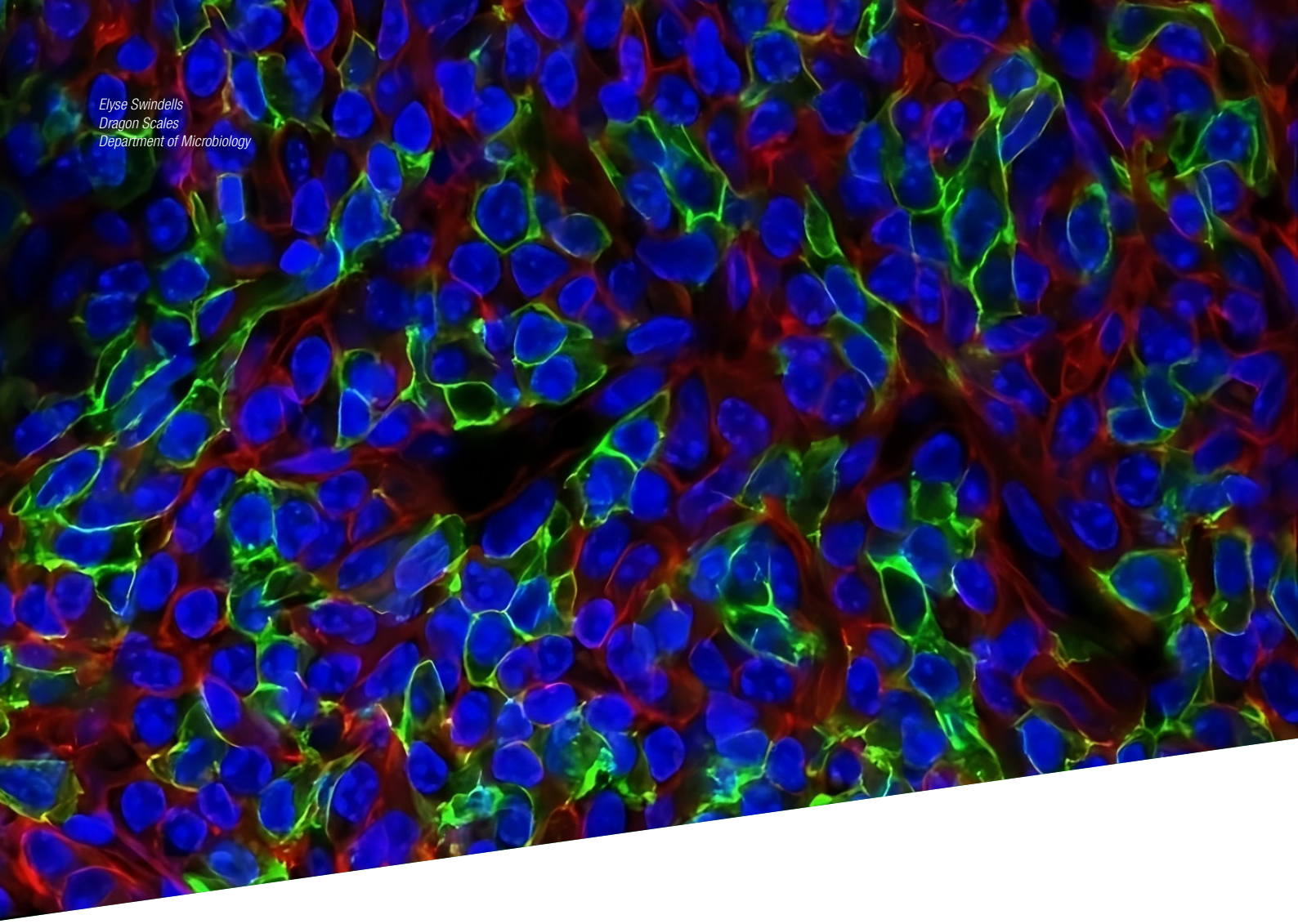
GEMMA SCHLEGEL
PHD
Area of study: Immunology

It is fascinating how the immune system has evolved to prevent infection and disease in a highly coordinated manner. I am motivated by understanding the intricacies of these cellular pathways and how they may feed into disease when the system is disrupted.

Studying immunology at Monash has equipped me with fundamental skills and knowledge that has allowed me to pursue a career in research. I have had the opportunity to practise scientific communication, experimental design, problem solving and critical thinking.

The immunology teaching staff create an engaging and well-structured learning experience. I have especially valued exploring the clinical and therapeutic implications of the field, and applying my skills through laboratory workshops.

ALEXANDRA BOSAK KARAVIOTIS
PHD
Area of study: Immunology



Elyse Swindells
Dragon Scales
Department of Microbiology

MICROBIOLOGY

Microbiology is concerned with the study of microorganisms, their diversity, structure, molecular biology and how they interact with humans and other living organisms in both harmful and beneficial ways. Microbes are fundamental for both our survival and planetary health. Some of the most important scientific discoveries have been made by microbiologists, including the germ theory of disease, development of vaccines, discovery of antibiotics, and the demonstration that our genetic material is encoded by DNA molecules.

Why should I study microbiology?

Microbiology impacts upon a wide range of areas including human and animal health, the environment and climate science, food technology and safety, and the biotechnology industry. Today, like no other time in history, the importance of microorganisms can be seen from the impacts of infectious diseases throughout the world, the emergence and spread of antibiotic resistance, the Human Microbiome Project and the use of microorganisms to safeguard our future and help solve some of the key global challenges of our time.

What will I learn about?

- Microbes in health and disease
- Molecular microbiology
- Microbial biotech and global applications
- Pathogenesis of infectious disease
- Medical microbiology

Where will Microbiology take me?

A Microbiology Major allows you to unlock a world of opportunities in the fields of biomedical sciences and biotechnology. Our graduates are exceptionally well-prepared for advanced studies, including research-focused programs, and are highly sought after in diverse fields. Whether youre aiming for roles in the biotechnology and pharmaceutical industries, teaching,agriculture and food production, diagnostic and analytical laboratories, sales and marketing or media and government, our program equips you with the skills you need. The critical, analytical and laboratory-based skills honed through our Microbiology Major provide invaluable experience, opening doors to numerous exciting careers.

I've always had a passion for biology and an appreciation for the natural structures and machinery within living organisms, especially on a microscopic scale.

I chose to study Microbiology due to my fascination with viruses and bacteria, how they cause disease, and how we can treat infections to improve human health. In doing so, I learned that microbes have a much larger role to play on our planet: they're involved in our evolutionary origins, our environment, agriculture and food, industry, sustainable development goals, and our future. From recombinant gene experiments to microbe diagnostics, conducted in modern laboratories with classes taught by expert researchers, my studies in Microbiology have equipped me with both research and transferable industry skills to contribute and make a difference in real-world settings.

The top two aspects I enjoyed most were collaborating with like-minded peers who share similar passions and gaining exposure to cutting-edge research, which inspires me to pursue further studies beyond my undergraduate degree.

DARREN KAI YI CHEE
Bachelor of Science Advanced - Research (Honours)
Area of study: Microbiology

PHARMACOLOGY

Pharmacology is the study of the effects of drugs on living organisms. You'll learn how drugs - whether natural or synthetic - affect biological systems. You'll also gain an understanding of how drugs can be used to treat specific diseases, and how new therapeutics are developed.

Why should I study pharmacology?

Knowledge about the ways in which drugs produce their effects is becoming increasingly important as the use and abuse of drugs becomes more widespread in our society. Understanding pharmacological concepts is fundamental to the safe and effective use of medicines by health professionals. Pharmacology is also central to the identification of new therapeutic targets, and enhances our understanding of human physiology.

What will I learn about?

- Principles of drug action
- Drugs and society
- Drugs in health and disease
- Neurological and endocrine pharmacology
- Modern drug development

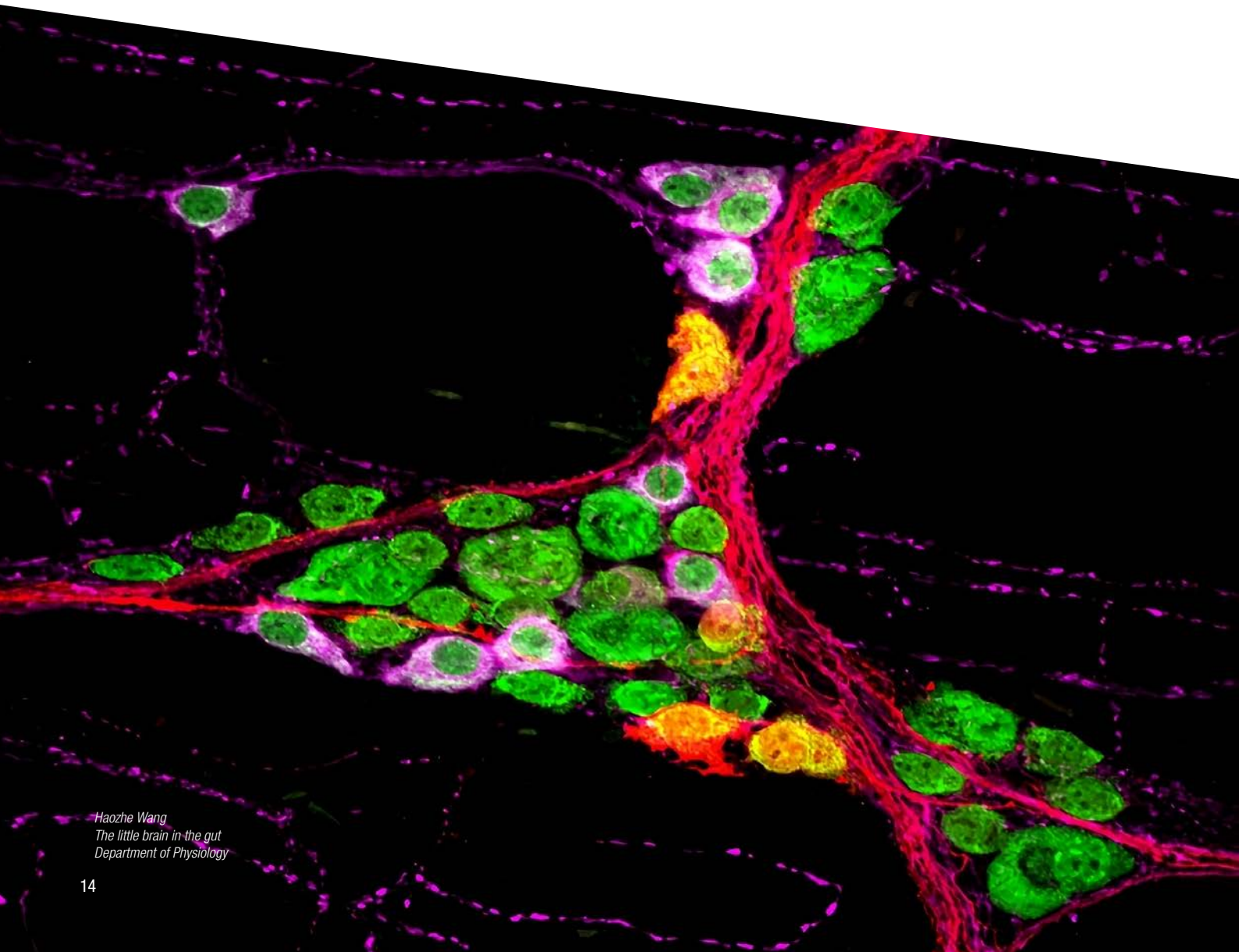
Where will Pharmacology take me?

A pharmacology major can lead a wide range of careers within the pharmaceutical industrial pipeline. This can include but is not limited to the following areas.

Research and Development
Involves lab-based research either within a university or company. e.g. Research Assistant, Lab Manager, Post-Doctoral Research Officer

Clinical Trials
Involves recruitment and assessment of new drugs and medical devices within human volunteers. e.g. Clinical Research Associate, Clinical Trial Coordinator, Biostatistician

Commercialisation
Involves the translation of research into a product someone will pay for. e.g. Marketing Associate, Market Researcher, Sales Representative



Haozhe Wang
The little brain in the gut
Department of Physiology

I first encountered pharmacology in my second year and it was the best experience both because of the content and how well the unit was run.

If you're interested in areas such as physiology, molecular biology, or biochemistry, then pharmacology would suit you. It's a broad area of science where you can choose to focus more on the physiology end of things, assessing how drugs affect body systems, or on the molecular side, developing drugs and investigating mechanisms of action.

There's a big focus on teamwork in the pharmacology assessments, which is an important skill, not just in life, but to set you up for a career in science. Through designing my own protocols and answering research questions, I've further developed critical thinking and problem solving skills, which are invaluable skills in scientific research.

The thing I love about pharmacology is feeling like I'm making a real difference. Being able to talk to patients with the disease that I research, hearing their experiences with current treatments and telling them about the drugs we are developing and our positive findings, have been some of the most rewarding experiences.

OLIVIA YOUNG
PhD
Area of study: Pharmacology

PHYSIOLOGY

Physiology explores how the body works, and how it's affected by dysfunction and disease. You'll learn how molecules, cells and organs interact to form a living creature. From nerves to muscles, from the brain to hormones, physiologists are concerned with functions at all levels, spanning the molecular and cellular levels to organs and body systems.

Why should I study physiology?

By studying physiology, you'll develop an understanding of the integrated function of the whole body. You'll study normal function of the human body as well as common examples of adaptation to unusual environments, such as high altitude. This area of study will also provide you with greater insight into the basis of many common bodily dysfunctions, including heart disease, infertility and ageing.

What will I learn about?

- Neuroscience of communication, sensory and control systems
- Endocrine control systems
- Body systems physiology
- Exercise physiology and metabolism
- Clinical and experimental cardiovascular physiology
- Hormones and reproduction

Where will Physiology take me?

Monash Physiology graduates generally undertake careers in health professions (43%), followed by research-related careers (18%) and business or law practice (14%). A quarter of the graduates in health professions become doctors, while the rest are spread across a diverse range of allied health areas with physiotherapy being the most popular. Among those in research-related careers, 39% pursue further studies (e.g., PhD), followed by 24% in research assistant roles within academic settings, and 15% in clinical trial coordination.

I've always been avidly curious about the brain and perception and how they work together to guide human behaviour.

I've focused on Neuroscience and have also gained a wealth of information about not only the brain and nervous system but also our other body systems. I've learned about how our brain manages to navigate the rich, busy, vast and immense world of sensory information that we're met with every second of every day, carefully selecting and filtering through what is important to us and ultimately guiding our behaviors to best respond to that information. Learning about this action at varying levels, from behavior and perception to neural networks and cellular processing, has proven to be invaluable knowledge both within and outside of my academic career.

The labs and practicals in Physiology units are some of the most fun and interesting! There's a hands-on approach to learning and one of my favorite classes was completing the 'Senses' practical where I got the opportunity to collect real psychophysical data and mimic how neurological disorders might affect that data.

The Physiology community has been a highlight! Whether they're fellow students who share the same scientific interests and passions, or academic staff/mentors/supervisors that I've had the pleasure of meeting and working both with, the community is generous and welcoming and the opportunities I've been kindly given have allowed me to grow immensely as a student, researcher and teacher of Physiology.

ISABELLE TAMBURINI
PHD
Area of study: Physiology

I have always had a passion for Science and studying in Physiology has enabled me to combine my interests in understanding better how the body works and what the implications are when things go wrong, right from a body systems level to a cellular level. During my undergraduate studies I majored in Neuroscience and I have developed a vested interest in Cognitive Neuroscience, and being able to complete my studies in neuroscience through Physiology has really developed my understanding of the brain from a mechanistic and functional perspective.

Whilst completing my higher research degrees (Masters and PhD) through Physiology, I have been exposed to the different ways in which research is conducted and implemented in both academia and teaching. I have really learnt to develop and implement critical thinking and problem solving skills when navigating new research techniques and experimental protocols.

I have really enjoyed the culture and environment in the Physiology department amongst both students and staff. Research is always an evolving field and there are many opportunities to keep on learning.

ZAKIA HAQUE
PHD
Area of study: Physiology

Jordyn Thomas
Composite
Department of Physiology

MONASH University

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FURTHER INFORMATION

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Course Code: M2003.

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