

# Undergraduate Research News Australasia

Australasian Council for Undergraduate Research – Issue 20 • November 2021

## Editorial



ACUR@ANU 2021 winners pictured with ACUR Chair Angela Brew and members of the conference organising committee at the closing ceremony. Left to right, top to bottom: Dr James Brann, Director of University Experience, ANU; Caitlin MacDonald & Rubay Tessema (conference organisers, ANU); Kira Simmons; Veronica Padilla; Andrew Quattrocchi; Professor Angela Brew (Chair, ACUR); and Rebecca Hetherington.

**Undergraduate researchers undertake truly inspiring and ground-breaking research, and many are obviously motivated by ‘wanting to do good’ and future-proofing the world. The enthusiasm that such research engenders is well captured in this issue of URNA.**

The recent ACUR@ANU conference was a highlight of 2021. Despite COVID-19 inflicted challenges and lockdowns, ACUR’s 2021 Conference went ahead and was the first ACUR conference to take place online. URNA Issue 20 therefore begins with an account of the conference by the conference organisers and this is followed by Vincent Zhang’s reflections on his conference experience from the student perspective.

A number of research reflections from students and academics then follow. Eve Poland describes

how, through a succession of summer projects she developed her interest in green chemistry, and senior lecturer Helen MacLaughlin describes how undergraduate research is integrated into the Nutrition and Dietetics degree at QUT. The Chair of ACUR, Angela Brew puts the work of ACUR in the wider context of initiatives focused on transforming higher education, and PVC Simon Handley’s reflection on his research experiences encourages student researchers to seek out the unexpected! COVID-19 has had unfortunate effects on international student engagement and Mehala Balamurali and student Karen describe one such difficult journey. There is also news from the ACUR Student Committee and two members of that committee also share their reflections.

URNA then turns to some short research insights by undergraduate researchers from various

universities. Molly Young has explored the use of DNA in forensics and suggests some areas for reform to avoid miscarriages of justice. Jack Hassall also suggests reform of the regulations of organ donation, while Nicholas Roufogalis discusses how to connect low cost modular housing units that can be used when temporary housing is needed. Dimitrios Havadjia’s concern is how to store and use recycled water in Sydney, while a team of University of Tasmania students carried out multidisciplinary research in mine waste rehabilitation. Finally, ‘How do bees know where they are?’ is the question Amber Gane set out to answer. At the end of this issue, there are some events to watch – some online, and don’t forget to look out for the featured resource.

**Dr Lilia Mantai**  
**The University of Sydney**

# “Your Search, Our Future”: ACUR@ANU 2021 Conference

## The 2021 Australasian Conference of Undergraduate Research was proudly hosted by the Australian National University (ANU) from 15-17 September 2021.

Sponsored by the Australian Bureau of Statistics, and supported by the John Curtin School of Medical Research and the ANU Gender Institute, ACUR@ANU was the first online ACUR conference. The conference welcomed 143 undergraduate (including Honours) student presenters from around the world following an international call for abstracts. In total, more than 200 students, staff and supporters attended ACUR@ANU globally.

ACUR@ANU student presenters represented 31 institutions from Australia, New Zealand, the United States, Pakistan, India and Singapore. Student presentations took place across 48 sessions, with each student presentation evaluated by two conference judges. Overall, 54 academic staff members from 31 institutions globally supported as conference judges, and 119 academic staff representing Australian and international institutions reviewed student abstracts. 58% of student presenters identified ACUR@ANU as their first opportunity to present their research, and the conference organisers wish to thank all reviewers and judges who provided formative feedback and a welcoming environment for our student attendees.

Congratulations to the winners:

### Oral presentation category (Joint First Place winners):

Andrew Quattrocchi  
The University of Sydney  
*Alzheimer's Disease: Perivascular Macrophages and the Blood-Brain Barrier*

Rebecca Marie Hetherington  
The University of Notre Dame  
*Governing Through Self-Care: Neoliberalism and Gendered Labour in the Lorna Jane Brand*

Veronica Padilla  
The University of New South Wales  
*Expression and Characterisation of a DNA i-Motif specific Nanobody*

### Poster presentation category

First place: Kira Simmons  
University of the Sunshine Coast  
*Low vegetable intake in pregnancy and associated maternal factors: a scoping review*

Second place: Amy Lu  
The University of Adelaide  
*The Secret Life of Poo: A Study of Kangaroo Island Echidna Health After the 2019-20 Bushfires*

Second place: Claudia Goodman  
University of Wollongong  
*A Scoping Review on the Preferences of Older Adults for Education Materials*

### Group presentation category (Joint First Place winners):

Asha Clementi and Rebecca Crisp  
The Australian National University  
*Reality or rhetoric: The role of education in achieving gender equality in Myanmar*

Jessica Turner and Narelle Jones  
The University of Adelaide  
*Cold blooded, but not unfeeling*

### John Curtin School of Medical Research Best Female Presenter (Joint winners)

Rebecca Marie Hetherington  
The University of Notre Dame  
*Governing Through Self-Care: Neoliberalism and Gendered Labour in the Lorna Jane Brand*

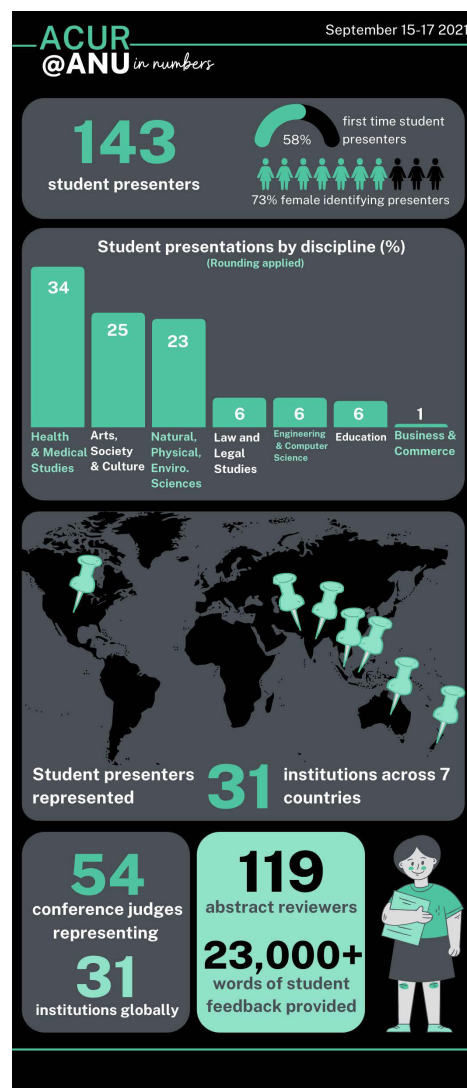
Veronica Padilla  
The University of New South Wales  
*Expression and Characterisation of a DNA i-Motif specific Nanobody*

In line with the central focus of ACUR@ANU on supporting undergraduate researcher development, the conference included a program of 12 events designed to connect students with peers and experts from around the world. More than 200 registered conference attendees joined engaging conversations and learning sessions, from the Python programming workshop, to a panel discussion on the methodological challenges of research in authoritarian and developing countries, and keynote speeches celebrating undergraduate research journeys. The conference organisers wish to thank all speakers who joined us from Canberra and beyond to support undergraduate research.

In addition to our sponsors and supporters, ACUR@ANU was generously supported by the ANU Academic Skills team, Lauren Bartsch from ANU Communication and Engagement, the broader ANU Engagement and Success team, the ACUR Executive and the ACUR Student Committee. The conference organisers wish to

acknowledge the extensive contributions of the ACUR@ANU Student Volunteer Committee: Fiona Ballentine, Lucas Greenslade, Oliver Hervir, Rhiannon Sandiford, Sheryl Singh, Sophia Ridolfo, Shruti Vellat and Sneha Bahl. Finally, congratulations to all student presenters! We have been overwhelmed with stories of success and enjoyment, and we are delighted to have collaborated with ACUR to welcome new members to the ACUR community.

**Ash Dowling, Rubay Tessema and Caitlin MacDonald**  
The Australian National University  
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# Making 360° Video Streaming Efficient

**Presenting at the Australasian Council of Undergraduate Research Conference in September was one of the highlights of my university career.**

It marked the conclusion of a year-long research project that I had embarked on with my supervisor, Dr Kanchana Thilakarathna, and our team at the University of Sydney.

Our team researched and created novel techniques to improve the streaming efficiency of 360° videos, the ones that you can watch using a virtual reality headset. The problem with these videos is that they're incredibly large, and difficult to stream effectively. One way to improve streaming is to not stream the entire video frame, but portions of it. After all, when you're watching a 360° video, you're only looking at one chunk of the frame, or 100° of the 360°. We call the 100° the user's viewport, and our method to improve streaming efficiency was to predict where users would look in the frame, using the contents of the frame itself.

Our basic idea was that the contents of a frame, such as the objects within it, their positions and speed, can affect where users look. Take for example, a 360° video of a rollercoaster ride where you're seated in a roller-coaster that's about to launch you into the sky. If you're like me and scared of heights, you're probably going to be looking at the rails of the rollercoaster, where all the action and motion is happening, rather than look around and admire the panoramic views afforded to you by being a 100m up in the sky.

And so, what we did was that we created a viewport prediction algorithm that encoded human psychological patterns e. g. you're more likely to look at objects associated with the scene such as the rails (object) of a rollercoaster (scene). The algorithm took in a scene (or video frame), identified its interesting (salient) regions, and then created a saliency map that

allowed us to predict where users would likely look. Our results showed considerable savings in streaming efficiency compared to the state of the art.

The whole research process was incredibly rewarding. Research offers you the opportunity to focus on getting to the core of a problem. To do well in research, you really have to understand the basic mechanics of your problem, and continually persist through the many challenges of research, from a lack of datasets to mixed results that invalidate your hypotheses. The biggest reward of research is the ability to not only produce something novel, but to present your findings to others, and that's what I loved about the Australasian Council of Undergraduate Research Conference.

In one zoom session, I could hop onto a presentation about cancer research, and then tune into a discussion about astrophysics, all within the hour! I also

thoroughly enjoyed the panel discussions on academic research, which covered important topics such as gender diversity in STEM and tips for conducting interdisciplinary research.

All in all, I would highly recommend undergraduate research for anyone interested in tackling challenging, unsolved problems and working with brilliant researchers and academics. I would also recommend the Australasian Council of Undergraduate Research Conference to all student researchers who are thinking about getting feedback for their ideas and presenting them to a diverse audience.

**Vincent Zhang**  
The University of Sydney



Link to the video: <https://bit.ly/3mOLT2i>

## Don't forget!! - NEW in URNA!

*Knowing that many of you read URNA in digital form, there are interactive elements that link you to further information without disrupting the current URNA reading experience that you so enjoy!*

*For example, click on the images above to view Vincent's presentation or follow the underlined hyperlinks throughout this issue.*

## Vale Les Kirkup

It is with great sadness that at the beginning of November we heard of the death of our colleague Les Kirkup. Les worked tirelessly to introduce research and inquiry experiences in science. Through initiatives such as his two Australian Learning and Teaching Council Fellowships, among other things, he broadened the national conversation on learning science through inquiry in Australian universities, engaging not only academics, but students, academic policy makers and others from outside the university sector including teachers and senior executives of the CSIRO. Through his teaching at UTS he demonstrated how even within the confines of a traditional lecture room, students could be enthralled through engaging in inquiry. His leadership will be sorely missed. Go to [ACUR Resources](#) and search for 'fellowship' to find his fellowship report.



# Catalyst for Climate

**I founded the UTAS Zero Waste Society and the Jane Waste and Sustainability Committee (at Jane Franklin Hall) during my time at university. This has allowed us to divert hundreds of kilos of food waste away from landfill, clean up local beaches, and provide information to help people live more sustainably.**

Next year in my Chemistry Honours project, I plan to develop a phosphorous-based “phosphangulene” molecular catalyst. One day, I hope to use my chemistry skills to convert CO<sub>2</sub> into something useful, to address and reverse the effects of climate change to ensure the long-term sustainability of the planet.

How did I get here? After completing my first-year at university, I participated in a chemistry summer research project. I had no idea what this would entail, but I did know that there were scholarships available, and any summer job that wasn't in hospitality was good enough for me!

To begin with, my head hurt from the exhausting quantity of information. I understood that I was making a precursor molecule to make something called phosphangulene, but I didn't know what that was or what it did. Seeing as my project was way cooler than anything we'd done in the first-year laboratory, I didn't mind that the chemistry theory bewildered me. As soon as I felt more comfortable with the project at hand, I asked what the point of all this was. “We're making a

catalyst!” my supervisor, Curtis, told me. Wow, I thought, that's super interesting.

My summer project ended with me making approximately 1.6 grams of what we needed to make – success! I became a volunteer researcher in my second year, completed another research project that summer in which I made some catalytically-active metal complexes myself, and undertook another summer research project after my third year. By now, I felt quite confident in the lab, like Harry Potter with the Half-Blood Prince's potions book clutched in one hand. It was at this point that I felt comfortable to ask: “What are we intending to use these catalysts for?”

“Small molecule activation” said Curtis grinning, clearly excited that I'd asked this question. “And what exactly is that?” I replied frowning, clearly frustrated with his proclivity for using chemistry jargon. “Ok, so CO<sub>2</sub> is a small molecule compared to something like DNA which contains billions of atoms. And CO<sub>2</sub> is a problem, right? So, there's at least three possible solutions:

1. We make less of it – we've tried this idea but until we find alternative fuel sources this isn't a viable option. Even when we do, there's already too much CO<sub>2</sub> in the atmosphere anyway.
2. We store it – seems good, but it's really just a band aid solution, what happens to it after storage? It's not going to work forever.



3. We use it for something. That's what we're trying to do. CO<sub>2</sub> is just carbon and oxygen right, and they're fine on their own so let's break the molecule up. But CO<sub>2</sub> is a very stable molecule and that's why we need catalysts. Making the right catalyst is the hard part, that's why we need scientists like us.”

Here I was doing “green” chemistry this entire time – I had no idea. I was amazed! The primary reason I wanted to go into chemistry in the first place was to help the environment.

**Eve Poland**  
**University of Tasmania**

# Letter from the Chair

There is no doubt that the pandemic has hit everyone hard. Enforced lockdowns have required us all to stay put. Travel, even to neighbouring universities, has been impossible. Over the past two years, universities have been forced to make some very hard financial decisions and this has had knock-on effects on ACUR's membership and on what we have been able to achieve. Nevertheless, in September we held a very successful conference thanks to our colleagues at the ANU who rose to the challenge of providing opportunities for students to present their research online. This conference also included keynotes focused on student career development, and we were delighted to see members of the

ACUR Student Committee acting as session chairs. All conference presenters subsequently become part of the ACUR community and so recently we were pleased to welcome 143 presenters into student membership.

Fundamental to engaging undergraduates in research are the ways in which higher education is transforming to meet the needs of an uncertain world. Contemporary society has challenged ideas about the generation of knowledge. Debates about the nature of knowledge are now commonplace. Facts and truths are continually questioned on the internet and in the social and print media. However,

the pandemic has shown us the value of scientific research to our everyday lives. It has highlighted the importance of evidence to every-day decision-making. When the chips are down, we need experts with scientific evidence. The capacity to think critically and to scientifically explore the evidence about the world around us has never been more important. The recognition that students at all levels need to develop a critical mindset through research engagement has grown internationally.



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# QUT Undergraduate Dietitians Partner with Real World Researchers

**Health practitioners have a problem. How do they find the time and skills to be excellent clinicians and expert researchers to provide high value healthcare?**

High value care happens when the best and latest research evidence is incorporated into day-to-day care of patients to ensure effective treatments, and positive outcomes. Dietitians and Nutritionists throughout Queensland have teamed up with researchers at Queensland University of Technology (QUT), developing a joint strategy to increase research capacity - in both Dietitians and in undergraduate students studying nutrition and dietetics. Over the last 5 years alone, undergraduate researchers from Nutrition and Dietetics at QUT have helped Dietitians and Nutritionists answer more than 50 research questions, resulting in improvements such as: finding and treating malnutrition in hospitals, helping researchers understand how nutrition during pregnancy and in early years can influence maternal and child health, and innovations like exploring how 3D printing can be used by the food industry.

At QUT, all Nutrition and Dietetics undergraduates complete an embedded Honours program, including studying advanced research methods and working on a real-world research project for 18 months. The research projects examine real-world problems because they're sourced from existing research programs run by researchers and clinicians. Undergraduate students are teamed with experienced researchers, post-graduate students, and novice dietitians who are also developing research skills - so the whole team benefits. It's a flexible and robust model which ensures sustainable undergraduate research opportunities, which are meaningful and contribute to improving dietetics practice, as well as embedding research as a core



skill in graduate Dietitians. Helen MacLaughlin, the clinician researcher leading the program, often links undergraduate students into research projects specifically designed to evaluate current clinical care practices, established research programs with available data ready for analysis, or to join teams synthesising research that will contribute to practice guidelines.

Academics get skills in people management and leading teams, which is great for new and early career academics who may not have experience in supervising others. We also grow the research capacity of clinicians and integrate student learning into practice. Undergraduate students gain real world research skills, spend time in a real-world work setting, which are valued by future employers when they graduate. Since 2012,

our undergraduate researchers have contributed to over 20 published research papers, and more than 40 conference abstracts, and several have enrolled in PhDs. Mary Hannan-Jones, academic lead for Nutrition and Dietetics at QUT says:

“To me it’s a sustainable research model, we have developed a robust training research experience for our students pitched at the right level for undergraduate training. Our projects are embedded in existing research programs and business as usual service evaluations. This is a unique feature in our course, our students get a meaningful experience working at a closer level with experienced academics, which doesn’t happen in all undergraduate courses.”

**Dr Helen MacLaughlin, Senior Lecturer  
Queensland University of Technology**

ACUR is dedicated to promoting and advancing undergraduate research because we believe that engaging all students in various forms of research and inquiry during their undergraduate years is a key way to bring about the critically informed citizenry which is so important in addressing the complex challenges that face the world and its people today. Over the course of the pandemic, in the move to online education, universities have demonstrated an incredible ability to adapt. Undergraduate research is not inconsequential. It is a fundamental aspect of a future-focused higher education. Engaging in research prepares students for their

uncertain future. Whatever form of research undergraduates experience, whether working in a science lab, or in a work-focused industry and/or community partnership initiative, or whether they are engaged in various kinds of research- or inquiry-based learning within their university coursework or their assessment projects, research experiences at different levels and different intensities provide students with the skills needed to cope with ambiguity and complexity.

We are always interested to know what Australasian students gain from their research experiences, and what they gain from ACUR. Our Student Committee recently produced a

video exploring this. You can see this on the [ACUR website](#). We know that some of our ACUR student conference presenters eventually go on to complete PhDs and then themselves become academics with a passion for engaging their own undergraduate students in research. We have been endeavouring to contact all our past undergraduate presenters to explore the contribution of ACUR conference presentations on their subsequent career development. The survey is still open, so if you have previously presented at an ACUR conference and have not yet completed the survey, please follow [this link](#).

**Emeritus Professor Angela Brew**

# A Message to Research Students

**A few years ago, I made a last-minute decision to run a marathon at midnight around Narrabeen lakes on one of the hottest January nights of the year.**

Undertrained and underprepared, I dragged myself around the 26 miles and hobbled away with acute Achilles tendonitis. During a subsequent therapy session, my physiotherapist noticed a pulsating lump in my neck and suggested I might like to seek a medical opinion. The diagnosis of an aneurysm in a major artery followed, together with an operation to remove two ribs, a painful recovery and a successful resolution.

Life, like research, can throw up unexpected outcomes. An ill-conceived plan to run a marathon in the middle of the night can lead to the resolution of a life-threatening condition,

just as the act of discarding Petri dishes on a lab bench can result in a discovery that will save hundreds of millions of lives. Serendipity is an unexpected event that occurs, often by chance, when we are searching for something else. It results in accidental and often impactful breakthroughs, such as Alexander Fleming's discovery of Penicillin in his discarded Petri dishes or Percy Spencer's discovery that microwaves can be used to cook food, from observing that his peanut bar melted as he tested the output of a magnetron.

Serendipity in research has been described as the act of finding answers to questions not yet posed. Sometimes the most important or exciting discoveries are the ones that we don't expect. So, how do we create the conditions for such an unexpected discovery? I would encourage

you to take more risks, plan a little less and explore a little more. As the History of Science shows, curiosity driven research is often the most reliable way to generate novel discoveries and innovations. As the next generation of research leaders, please do seek out the unexpected. You never know, one day a serendipitous discovery could help you to put your mark on history, have a transformative impact on society or even save your life!

*This article was originally published in Macquarie University's Graduate Research Academy newsletter HDR matters August 2021. Republished with Simon's consent.*

**Simon Handley, Pro Vice-Chancellor Graduate Research  
Macquarie University**

# Impact of COVID-19 on International Students' Education

**The raging COVID-19 continues to affect lives across Australia. One of the most vulnerable groups subject to COVID-19 are international students.**

With the unexpected shutdown of universities across the country and the lockdown in 2020, many international students residing in Australia were left stranded, unsafe and hungry due to their understandable lack of preparation, unstable jobs and unreliable housing arrangements. Many international students from China flew back to China for the Chinese spring festival in February 2020. COVID-19 then unexpectedly deteriorated the wellbeing of the country's population along with the rest of the globe, leaving the students stuck in their home country. Postgraduate and undergraduate thesis students who have already commenced their project have been heavily affected as they needed more time to complete their projects. Some project objectives had to be changed because the students' presence in Australia was essential for project completion.

I was challenged with frequent requests from undergraduate students to provide thesis topics that can be completed from their home country. While this is possible with certain domains and regulations, doing projects in a different

environment inevitably disadvantages students as they are subject to unanticipated variables that will affect their experiment. Unexpected complications also affected students in Australia.

One of my students, Karen, shared her journey of completing what would be a one-year project in three semesters:

*"My project is a highly computation integrated task related to the detection of tuberculosis bacteria. The project was scoped for 2019-2020. When I got stuck in Heilongjiang after travelling home for the Chinese Spring Festival, I thought this would be over soon. However, Australia closed its borders to Chinese students very soon and panic started to spread. Many of my friends started planning to travel for a few weeks to a third country in hope to re-enter Australia. This wasn't a choice for me as my parents were worried for my safety. So I was watching and waiting to travel back. I had so many plans for my life in Australia, and the situation made me really upset. I was frequently communicating with the administration of the University, my supervisors and some close lecturers. And finally, as the border of Thailand closed, I decided to go to Malaysia for a 14-day transition to then re-enter Australia.*

*Unfortunately, on my way back, on March 20th, the Prime Minister closed the border to all the countries,*

*and Malaysia had gone into lockdown. I returned to China for a 35-days hotel and self-quarantine along with 3 COVID-19 tests. The situation affected me so much I developed insomnia for quite a long time, due to both the pandemic and other problems intensified through the pandemic. My small family business was heavily affected by the pandemic for around 4 months. I was constantly in quarantine and all of my friends seemed to have made better decisions. I suffered from self-doubt. I decided to defer my thesis project to the next semester. In July, I started to regain positivity and get back to my project.*

*My supervisors Dr. M. Balamurali and Dr. A. Kyme were extremely helpful in this regard. Supervision was managed online and the University arranged remote access to the lab computer. While there were initial challenges, I found the whole research process interesting and dynamic. The most challenging part was not writing the thesis but the daily struggle to remain mentally strong and positive. I wish that students in similar situations find peace of mind and learn to stay resilient in current times."*

**Dr Mehala Balamurali, Research Fellow  
Australian Centre for Field Robotics  
University of Sydney**



# ACUR Student Committee Report

The Student Committee has changed leadership. Throughout 2020/21, Olivia Jessop has served as the Head of the Student Committee. As URNA Issue 19 reported, under Olivia's leadership the committee has established critical committee service roles, national and international events and projects. Olivia has been crucial to facilitating the outreach of ACUR and has vastly expanded the role of the Student Committee within the organisation. With the year now concluding, Olivia is succeeded by Max Kirkby.

Max, a current biomedical/mathematical sciences student at the ANU, will serve as the ACUR Student Committee Head for 2021/22. We look forward to working with him throughout the upcoming year on shaping the future of ACUR and fostering new domestic and international connections with our compatriot organisations. The ACUR Executive and Max wish to thank Olivia for her hard work over the years and contributing great energy and ideas in advancing ACUR's

mission. We wish her all the best for her PhD and other future academic endeavours.

Below we capture two insights from members of the 2020/21 ACUR Student Committee. Both Foti and Melody were integral members of the committee this year, involved in numerous projects concerning public outreach, ACUR promotion and member service design. The ACUR Executive and Max again thank them for their work!

## Student Committee Members Reflect on Research Engagement and Participation

### Reflections of a People Pleaser

It was the start of summer research, and I entered the office of QCMHR wide-eyed like a kid in a candy store. At this point I was wrapping up my first year of undergrad, and this was the first experience I was getting that wasn't my high school retail job – and I got excited. The thing about me is that, like many others, I have a hard time saying no. If an opportunity presents itself I'm the first to take it, and take opportunities I did.

Within a month of summer research, it definitely wasn't all I was doing. I picked up a flashy industry-related job with my newly polished CV and had to reschedule my research days, chopping and changing to squeeze everything in. This repeated with me getting a second job, and then a volunteering position, and then student committees, and suddenly I had changed my roster for research five times. Needless to say, this frustrated my supervisor and derailed the work we were doing.

After reflecting on some discussions, I came to realise that the people-pleasing behaviour of taking every opportunity doesn't actually please people at all. When you're stretched so thin that you are shuffling around your various activities, it affects your colleagues who can't afford to be working like a deck of playing cards. This was the most important lesson I learned over summer research; opportunities are shiny, exciting, and novel – but be selectively enthusiastic, stay dedicated, and don't overcommit.

**Foti Paradisis**  
The University of Queensland



### Increasing Participation in Undergraduate Research in Suriname

My name is Melody Hoefdraad and I am from a small Amazonian country called Suriname. I'm currently a final year Sociology and Development studies student at the Anton de Kom University of Suriname. Over the past two years, I've been a research assistant for Dr. Kirtie Algoe at the Institute for Graduate Studies and Research, Suriname. These past two years

I've primarily assisted with research projects focused on religious and ethnic diversity, conflict, politics, and government policy. As an RA I've assisted with everything ranging from collecting and analyzing data, doing literature and book reviews to co-authoring a paper on government restrictions on religion and levels of social hostility in the plural societies Suriname, Guyana, and Trinidad. The first project I had the opportunity to assist with was about Ramayana and Hindustanis in Suriname. This research project looked particularly at the interaction between ethnicity, religion, and community-building among the East Indian population in Suriname. Other research projects have been about political mobilization based on ethnicity, and the instrumentalization of social media during the 2020 elections in Suriname, and religion and healing. Currently, I'm writing articles on the historical development of religion and religious institutions in Suriname in the period between 1975 and 2020. I'm also conducting research on the relationship between ethnic politics and cultural pluralism in Suriname under the guidance of Dr. Kirtie Algoe. Engaging with undergraduate research these past two years has been a very meaningful and rewarding experience, on both a personal and professional level. It has made me very passionate about bringing other students into the fold of undergraduate research within the social sciences. Being an RA has also given me a real sense of purpose on campus.

**Melody Hoefdraad**  
University of Suriname



# Research Insights

Undergraduates are engaged in research on a vast range of topics and this is reflected in this section. We present some research stories featuring research conducted as part of degree coursework or other research opportunities such as research internships, or research assistantships. Articles are presented in a journalistic style. For further information and references please email the authors.

## Law vs Science: DNA, Wrongful Convictions and the Requirement for Reform

**My research explores how DNA evidence contributes to wrongful convictions in Australia. DNA (deoxyribonucleic acid) contains the unique genetic material of all known organisms. In criminal investigations, DNA is a powerful forensic tool for identifying the guilty and excluding the innocent. However, there is insufficient regulation of genomic evidence during investigation, analysis and litigation. As demonstrated in various Australian cases, this failure has the potential to result in serious miscarriages of justice.**

Genomic evidence is primarily used in cases involving sexual offences, homicide, and other serious criminal offences. DNA can be obtained from several biological sources, including blood, hair, urine, saliva, and seminal fluid. These samples are collected from crime scenes or directly from suspects, then transported to laboratories where DNA profiles are obtained. From this, polymorphisms (variations in DNA) can be observed. These are compared with samples

stored within databases, which may be used to identify, confirm, or eliminate suspects in criminal investigations.

Once two DNA profiles have been established as a 'match', the significance must be interpreted and calculated. This is typically expressed statistically as a match probability or likelihood ratio. If the matter proceeds to trial, the probability of the DNA match must be communicated in litigation. The audience of forensic findings typically include investigators, lawyers, judges and jurors who generally lack scientific backgrounds or a basic understanding of genomic evidence and statistics. A common misconception amongst this audience is that DNA evidence is infallible and provides a conclusive determination of a suspect's identity.

My thesis constructs case studies of Australian common law to reveal how DNA evidence has contributed to wrongful convictions. The conviction of Frank Button for rape was overturned only after DNA testing performed following the trial excluded him as the perpetrator. In *R v Jama*, inadequate cleaning in a Crisis Care Unit caused contamination of DNA samples, resulting in the wrongful conviction and imprisonment of Farah Jama. *R v Keir* involved a conviction for murder which was later overturned due to prosecutor's fallacy. These cases demonstrate the potential consequences

of genomic evidence being miscommunicated, misunderstood, or relied upon too heavily, such as the imprisonment of more innocent people.

Inadequate regulation regarding the analysis and communication of genomic evidence in litigation provides a framework which fails to adequately mitigate the likelihood of miscarriages of justice. To address this, my thesis recommends several areas for reform, including the incorporation of innocence testing and post-conviction review schemes, improved training and education for expert witnesses and legal professionals, and increased reporting and oversight obligations. These reforms will mean that genomic evidence will have significant probative value in reliably securing the convictions of the guilty and acquittal of the innocent. Failure to implement these recommendations has the potential to result in further injustices and increased distrust of DNA evidence.

**Molly Young**  
University of Canberra  
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## The Cadaveric Organ Shortage: A Result of Australia's Organ Procurement Framework?

**Organ donation and transplantation are effective and well-established treatments, involving the retrieval of a relatively scarce resource from donors for transplantation into compatible recipients, generally in replacement of a failing or failed organ.**

Science now enables whole organs, including the heart, lungs, liver, pancreas, and kidneys to

be donated, as well as tissues such as the heart valves, corneas, tendons and skin. The objective is to save lives or significantly improve quality of life, as it is a vital and often last resort treatment for many illnesses and diseases.

In Australia, organ donation is premised upon the altruistic donation of organs without expectation of reward or even acknowledgement by those who benefit. Altruistic organ donation is a respectable – indeed, 'noble' – cause, garnering support from Australian officials and the wider community. However, despite Australia's stated support for organ donation, low levels of actual organ donation (distinct from stated intention to donate) fail to keep abreast with demands for transplantation. Moreover, as Australia's population ages and with the increased incidence of lifestyle diseases including obesity and Type 2

diabetes, this demand is anticipated to grow exponentially.

A national survey on Australian donation and transplantation activity published in 2021 revealed that at any one time approximately 1,650-1,700 Australians are waitlisted for transplantation per annum. An additional 12,000 are on dialysis – many of whom require a kidney transplant. As compared against the reported 1,444 organs received from 548 donors in 2019, and the 1,270 organs received from 463 donors in 2020, the number of individuals waitlisted exceeded the supply of organs by approximately 206-256 in 2019, and 380-430 in 2020.

My thesis argues that Australia's organ donation and transplantation sector is in need of significant reform if the supply is to ever meet the demand. Indeed, the nation's low



rate of donation is a testament to the inadequacy of its current system. A lack of harmonisation in the laws and policy used to regulate organ and tissue selection, removal and allocation for transplantation are among the barriers identified within my thesis that limit the supply of organs from potential donors.

My research addresses such barriers by analysing material from primary and secondary sources using a qualitative and quantitative approach to provide evidence-based advice

and recommendations to develop a long-term strategy to increase organ donation rates. In doing so, a viable reform process to translate these recommendations into legislative and policy reform is identified. In giving effect to this process, the intention is to galvanise discussion through publication of my research in a public forum, so as to confront a persisting issue of health policy that has a profound and detrimental effect upon Australian citizens and their families.

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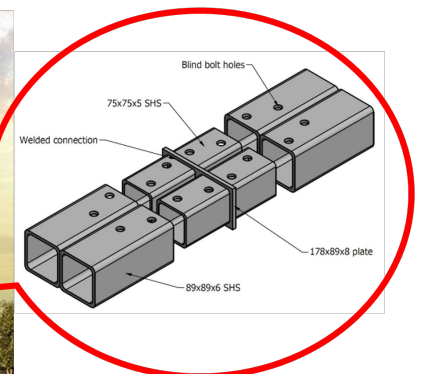
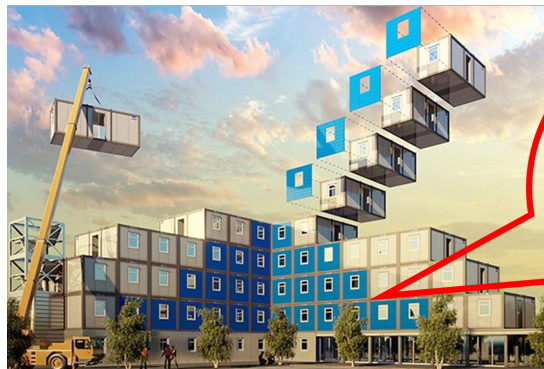


## Innovative Quick Assembly Inter-Module Connection Design

**This study developed an innovative inter-module connection design that only requires access from one side, thus making assembly and disassembly of the structure quick and simple. The proposed design can have a significant impact on the construction and reuse of temporary disaster relief shelters.**

In the rapidly evolving world of the construction industry, sustainability is becoming a major focus in the design, manufacture and usage of projects. Modular construction techniques are emerging as a more prominent sustainable solution due to their vast advantages in reduced cost, fast tracked schedules, increased safety and higher overall quality. Modular construction includes the assembly of separate modules prefabricated in a warehouse through strong inter-module connections. However, for this solution to be practical, innovation is required in the small details of the design. This identified a gap in the existing research relating to a standard procedure for designing innovative, sustainable semi-rigid inter-module connections to complement the advantages of modular construction. The research undertaken looked at designing a connection of this style, with a focus on reuse, for an application of temporary disaster relief housing after events such as floods, bushfires, and hurricanes.

To explore the behaviour of the connection, a finite element analysis of the model was completed in general-purpose finite element software ABAQUS. The connection modelled consists of a middle connector piece, which attaches to the vertical support members of



the modules through a blind bolt installed from outside. By only requiring access to one side of the connection, assembly and disassembly become quick and simple, making the design highly suited for a temporary disaster relief shelter. The results of the analysis showed no limit state design concerns under axial and shear loading for an assumed region D cyclonic wind loading region in Exmouth, Western Australia. The moment behaviour of the connection was identified as the critical area requiring further investigation. Overall, the results demonstrated the connection was able to safely withstand all the design forces determined through a 3D model of the structure with reduced end-moments due to the semi-rigid behaviour of the connection.

To accurately portray the semi-rigid behaviour of the connection, a 3D full scale structural model was developed in a widely used structural analysis software in Australia, SpaceGass. The section properties of the equivalent structural members were defined by equating the axial stiffness and the flexural stiffness derived from a detailed ABAQUS model. By definition, the axial stiffness of the connection is dependent on the cross-sectional area of the member. The flexural stiffness, on the other hand, is dependent on the second moment of area of the member. By equating these relationships, an equivalent

member section can be specified to accurately portray the connection behaviour.

The aim of this research was to provide a foundation for future engineers and designers to exploit the advantages of modular construction techniques through simple, innovative design of the inter-module connections. The connection design provides the platform for further exploration into a sustainable solution, while the semi-rigid design model provides a method of design that can be widely adapted and applied for similar connection types. By proposing and testing a quick assembly design, which only requires access from one side, it sets a benchmark for future design of reusable connections for temporary disaster relief structures. Successful design of these inter-module connections provides the key to unlocking the advantages of modular construction and working towards a sustainable and resilient future.

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## Toilet to Tap: Bridging Sydney's Water Gap

### After a turbulent 15 years for potable recycled water in Australia, is it finally time for Sydney to embrace the reuse revolution?

Australia has the highest surface water storage per capita in the world, which makes it uniquely threatened by climate change, which promises to reduce the consistency of rainfall, and thus inflows to dams and rivers. The NSW Department of Planning, Industry and Environment, reports that Sydney has experienced a 50% drop in average inflows in the last 30 years. Despite several recycled water for non-potable use projects being constructed in Sydney with relative success, Sydney needs to not only stabilise its existing supply, but find an additional 250GL/year by 2060 to cope with increasing populations.

Potable reuse has been used successfully across the world for over 50 years – the first system in Namibia is still on line today, has never

experienced a bacterial or viral outbreak over the course of its operations, and can supply up to 50% of the city of Windhoek's daily water needs. Systems using variations of the technology, including reverse osmosis, have been operational in the USA and Singapore (among others) for over 20 years – with Australia being late to the game, only opening its first potable reuse plants in 2006.

They have been to mixed success – Perth's groundwater recharge system has been doubled in size, but Queensland's Western Corridor Recycled Water Scheme, a \$2.5 billion system, has not ever been put into full production mode due to community backlash, coming off the back of the infamous community vote in Toowoomba, where a recycled water scheme was defeated by community vote, despite the town's long history of strict water restrictions.

As a first step, an indirect potable reuse water treatment plant at Cronulla, in Sydney's south-east could fill 13% of the water needs required for the city by 2060. By discharging into the closest water storage, Woronora Dam, a retention time of over 400 days can be achieved, reducing the risk of disease outbreaks to virtually zero. By utilising renewable energy for the pumps, a system located here would have the low capital

construction costs and could utilise the design principles of the existing advanced water treatment plant at St Mary's which currently provides water for environmental replacement flows.

To avoid the community backlash issues faced in Queensland, this new system would include a community education centre, a clear, simple, and focused education campaign, and, somewhat unintuitively, not include a community vote, which has been shown to show division and create conflict.

With the NSW Government finally coming around to the idea of domestic use of recycled potable water, after many years of policy opposition, this design shows the system is not only possible, but inevitable if Sydney wants to remain a liveable city in the face of a changing climate.

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## What a bee sees

### What do these intrepid little pollinators see and how does that affect their foraging behaviour?

Summer of 2020/21 gave me the exciting opportunity to gain a little insight into the general sight of a local and underappreciated species of bee: *Tetragonula carbonaria*.

In Australia there are approximately 2000 species of native bees that we know about, and most of our endemic bees are solitary. *Tetragonula carbonaria*, *T. hockingsi* and *Austroplebeia australis* are three social native bee species that produce honey and are often referred to as 'sugar bag' bees, because of their uniquely shaped honey storage pods. All three of these native honey bees are currently enlisted in the macadamia, lychee, watermelon, blueberry, mango and avocado industries (to name a few).

Despite the widespread use of native bees in agricultural pollination, little work has been done to better understand how they function. In 2016, a study of *T. carbonaria* regarding their visual abilities observed colour preferences for stimuli of blue and blue-green. This knowledge can help us to better understand which flowers *T. carbonaria* are likely to target as a preference.

However, the study I was fortunate enough to participate in, led by Dr Makinson of Western Sydney University, pulled back on the lens and looked not at the eyes of the bee, but the behaviour of the hive when given visual landmarks to indicate the location of a food source.

Interestingly we observed that *T. carbonaria* are less likely to use visual landmarks to map out their surroundings and more likely to follow scent trails carried on the wind. Preliminary work done with *Austroplebeia australis* indicates that they may be more reactive to visual stimulation, but more work needs to be done to confirm these initial observations.

A better understanding of how bees behave and perceive their surroundings can aid our farmers with better placement of hives during pollination seasons. Something as simple as checking the weather report for prevailing winds prior to hive placement, may be able to increase the efficiency of pollinators and thus yield better crops come harvest.

The Summer Research Program I participated in was a uniquely wonderful experience that I would highly recommend to any student. I gained unrivalled knowledge and skills that I would not have achieved from my degree alone.

Despite spending my summer in an exposed field on 40+ oC days dodging ticks, wolf spiders, snakes and the occasional lightning strike, I would do it all again in a heartbeat. Not just for the knowledge gained and honey sampled, but to hang out once more with the adorably fascinating farmhands that are *Tetragonula carbonaria*.

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## An Enduring Problem: Characterising legacy mine waste through multidisciplinary research

**In 2020, three University of Tasmania environmental Earth Science Honours students, supported by Mineral Resources Tasmania (MRT), undertook a collaborative and multidisciplinary approach to addressing the problem of mine waste characterisation and rehabilitation.**

The legacy Endurance Mine is an abandoned alluvial tin and kaolin mine located in northeast Tasmania. By integrating hydrogeological, geochemical and geophysical methods, their research aimed to effectively characterise the quartz- and aluminosilicate-rich sandy gravel mine waste, disposed of between 1874 and 1982. Since closure, Acid and Metalliferous Drainage (AMD) has been identified in groundwater and surface waters at the site and continues to impact the local environment. A series of lakes have formed in the legacy mining pits, the largest of which is Blue Lake. The lake is used for public recreation despite having a pH between 2.7–4 and aluminium (Al) levels above ANZECC 2000 recreational guidelines.

Wei Xuen Heng conducted a geophysical survey of the Endurance Mine waste, using Ground Penetrating Radar (GPR), Electrical Resistivity Imaging (ERI) and near-surface seismic. The resulting geophysical models were used to estimate depth to the water table and weathered granitic basement, the thickness and internal structure of the mine waste, and to identify preferential pathways for contaminant transport. These models assisted Heng's calculations of

the volume and mass of the mine waste. The geophysical interpretation of granitic basement and mine waste depth were also compared with stratigraphy logged and sampled during drilling of groundwater wells. Geochemical analyses such as conductivity measurements and paste pH were compared with the responses of electrical methods (DC resistivity, EM and GPR).

Olivia Wilson's research aimed to understand the transport of AMD through the mine waste groundwater system. This was investigated by installing nine groundwater monitoring wells. Stratigraphic logging, slug testing, and surface water observations were used to generate a hydrogeological model, which indicated southward and westward groundwater flow, from Blue Lake to Ruby Lagoon. Subsurface channels (observed in Heng's geophysical models of the granitic basement) were interpreted to be controlling the flow of AMD-impacted groundwater towards discharge features Ruby Seep and Ruby Lagoon.

Eliza Fisher's study focused on characterising the geochemistry and mineralogy of the mine waste and pit lake sediments across the site, using integrated ICP-MS, XRD, SEM/MLA, kinetic testing, and geochemical modelling. To understand the geochemical controls on the generation and transport of AMD, representative samples were collected during the installation of groundwater wells. Lake sediment

cores were collected from Ruby Lagoon and Blue Lake to better understand the mobility of trace metals. Integration with Olivia's hydrogeological model confirmed Ruby Seep as a groundwater-fed discharge to Ruby Lagoon, where the precipitation and dissolution of iron (Fe) (oxy) hydroxides and Fe/Al hydroxysulfates buffers acidic conditions at pH ~ 3.0.

The three studies have contributed to a more holistic understanding of the complex and heterogeneous nature of AMD generation and transport at Endurance Mine. The novel collaborative approach demonstrated by these research projects highlights the importance of cross-disciplinary studies to better inform mine waste remediation and monitoring across northeast Tasmania and further afield.

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### Featured ACUR Resource

*The Undergraduate Research Student Self-Assessment (URSSA) is an online survey instrument for programs and departments to use in assessing the student outcomes of undergraduate research (UR) in the sciences. URSSA focuses on what students learn from their UR experience, rather than whether they liked it. It includes both multiple-choice and open-ended items that focus on students' gains from undergraduate research. It is readily adaptable for use in other disciplines.*

*<https://www.colorado.edu/eer/research-areas/undergraduate-research/evaluation-tools-undergraduate-research-student-self>*



# Upcoming Events

## Participate in ACUR research

If you presented at past ACUR conferences, tell us about it [here](#)

If you participated in the 2020 ACUR Writing Competition, tell us about it [here](#)

## Contact us

For further information, or to submit an item for consideration for the next newsletter, contact:

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URNA is a publication of the Australasian Council for Undergraduate Research, appearing in May and November of each year.

The USA Council on Undergraduate Research is planning online events which may be of interest in Australia and New Zealand.



## National Conference on Undergraduate Research (NCUR) 2022 @home | April 4 - 8, 2022, Virtual

NCUR 2022 @home is a conference dedicated to the celebration and promotion of undergraduate research student achievement. This conference provides models of exemplary research, scholarship, and creative activity while offering student career readiness development. As a virtual conference in 2022, NCUR will be providing programming spread out over a week's time that includes primary education taking place in learning cohorts within the same discipline, poster and oral presentations, and as a new addition this year, an opt-in competitive element.

## Undergraduate Research Week | April 18 - 22, 2022



CUR has designated a week in April each year as Undergraduate Research Week (URW). This is a national celebration in which CUR showcases what other campuses are doing to celebrate UR, congratulate students on their research, and thank those faculty and mentors who have helped guide the way for UR.

## British Conference of Undergraduate Research (BCUR)

BCUR is presenting an Undergraduate Research Showcase 2022, 24 January - 28 January 2022. The Showcase will take place online and in-person throughout the week. Submission is open to students in all years, including alumni that graduated in the academic year 2020/21, from all disciplines across campuses.

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