The Royal Society OF VICTORIA
Promoting science since 1854

Inspiring AUSTRALIA Victoria

SCIENCE VICTORIA

JUNE 2023

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Royal Children's Hospital, Parkville, Victoria. Image: a.canvas.of.light via flickr (CC BY 2.0)

IN THIS ISSUE

SCIENCE VICTORIA

This Edition: The Future of Healthcare

With Victoria's healthcare transformation towards predictive and preventative medicine, coupled with a growing population nearing 8 million by 2032, we face a pivotal moment in shaping a proactive system that empowers individuals while protecting the population. In this edition, we look at some of the considerations for a healthier future for Victoria and Victorians.

On the Cover: A medical study room for students at Bendigo TAFE, Bendigo. The training and ongoing support for health and community service practitioners throughout Victoria, particularly in regional and rural areas, is vital to the sustainability and transformation of the healthcare system. Photograph: Alex Cimbal

Please note that the submission deadline for content to be included in the July 2023 edition of *Science Victoria* is **5pm, Friday 16th of June 2023.**

AN END TO LOGGING IN VICTORIA'S NATIVE FORESTS

Mike Flattley
CEO, The Royal Society of Victoria

The days are short, the nights are cold, and it's time once again for the compelling Autumn Festival of State and Federal Budgets, as we collectively squint between the lines to determine the fates of programs, institutions, and entire industries.

On the industry front, the recent announcement of the cessation of logging operations in Victorian native forests at the end of this year has certainly been rocking the environmental science network. Logging communities, already transitioning on the initial cessation timeline of 2030, will be sitting with heightened uncertainty while programs are brought forward to retrain and redeploy regional workers. That's not easy.

I'm far less sympathetic to the loss of primary resources for the production of toilet paper by an offshore company, our delirious pandemic panic buys notwithstanding. In terms of timber, however, I share concerns for maintaining a regional primary industry; certainly, it makes little sense to first sequester carbon in wood, which remains one of the world's most sustainable building products, only to ship it across the state, continent or globe and accrue a hefty carbon footprint. Until we've made suitable, carbon-neutral energy transitions for production and freight (see our **Letters** this month), processing timber for market close to the point of harvest – and, ideally, close to the mass market – is an important factor for both a climate-friendly industry and regional employment. I note there are currently 382,600 hectares of plantations, new and old, providing both timber and pulpwood supply. Indeed, the Victorian Department of Jobs, Skills, Industry and Regions states "currently five out of six trees harvested in Victoria are from plantations."[1]

Victoria's unique and increasingly fragile biodiversity must persist in an era of rapid change and challenge, for everyone's sake. My thanks to our state leaders for making an important call. This must now be matched with suitable resources for Parks Victoria and regional communities to manage Victoria's native forest estate effectively and address the many fragile ecosystems needing long-term repair and stewardship.

Certainly, the establishment of a new National Park in Victoria's Central Highlands has been the Royal Society of Victoria's science-based position since 2016. This aligns with the broader advocacy to establish a "Great Forest National Park."[2]

Moving on and looking ahead, two notable highlights include thought-provoking sessions on the challenge of predicting the contribution of melting glaciers and ice sheets to sea level rise from Professor Andrew Mackintosh on 22 June, and a challenge from Adjunct Professor Philip Zylstra to the culturally and scientifically complex arena of fire ecology with "Decolonising Fire Science" on 13 July. We also have a stunning opportunity to hear from the two founding proponents of "Green Chemistry," Professors John Warner and Paul Anastas on 7 July – keep your eyes peeled for details!

My thanks to all contributors to this month's edition – next month we address "Careers in STEMM" and, as always, welcome contributions as letters or articles to our hard-working Editor, Scott Reddiex at **editor@sciencevictoria.org.au**. Enjoy the read!

Mike Flattley
CEO, The Royal Society of Victoria

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SCIENCE VICTORIA, VOLUME 3, NUMBER 5, JUNE 2023
The Monthly Publication of the Royal Society Victoria - Established 1854 for the promotion and advancement of science. Supported by the Inspiring Victoria Program

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Acknowledgement of Country:
The Royal Society of Victoria acknowledges the many First Peoples of our continent, their vast history and connection to the lands and waters within and beyond the State of Victoria, and the valuable cultural and scientific knowledge held by the Elders to care for Country. We acknowledge our headquarters are located on Wurundjeri land, never ceded, and convey our respect to Elders past and present. The RSV welcomes all First Nations people, and seeks to support and celebrate their continued contributions to scientific knowledge.

GREENWASHING, POLLUTANTS, AND HUMAN HEALTH

Rob Gell AM MRSV
President, The Royal Society of Victoria

The Royal Society of Victoria's council recently spent a day in 'retreat' discussing a range of issues and opportunities.

As our operating environment changes, we review our strategy and operations, and our capacity to deliver meaningful outcomes in our role as promoters of science to the wider community.

Many thanks to our Vice-President Dr Catherine de Burgh-Day and Secretary Mr Jeffrey Luckins for instigating the day and drawing our deliberations together. We are focussed on the promotion of Ecologically Sustainable Development, and we seek to work towards resolving the three United Nations Environment Programme (UNEP)-acknowledged existential crises: climate change, threats to our biodiversity, and pollution and waste.[1]

A key challenge identified in the RSV's Strategic Plan is the 'rise of misinformation', and how we might counter it so that we best support all aspects of society to make informed decisions.

One of the increasingly common forms of misinformation is 'greenwashing', which is the widespread practice of using misleading language to claim positive environmental credentials for a product or service.

Climate-related claims such as 'carbon neutral' have most recently been exposed as misleading; 'net zero' claims are also under scrutiny as carbon-offset programmes are exposed as providing little real value in greenhouse gas emissions reductions.[2]

It's not an insignificant issue, and different groups are taking action against the practice: the Australia Institute filed a complaint against the Australian Government in February this year, suggesting that 'Climate Active' – the government's 'carbon neutral' certification scheme – may be misleading and deceptive.[3]

In early May, the European Union Parliament voted to prevent companies from making unsubstantiated product and service claims to combat greenwashing.[4] A week later, the UK's Advertising Standards Authority's (ASA) announced that it will begin stricter enforcement of green claims, particularly around carbon offset products that claim a purchase will not make global heating worse.

In the last twelve months there have been legal proceedings against food manufacturers, cosmetics, cement and oil companies and airlines. Misleading claims are not limited to climate issues, however.

I have recently been made aware of a claim made by a horticultural company selling Nufarm's herbicide 'Weedmaster DUO Glyphosate 360' with the claim that it delivers an "aquatically approved surfactant that is 'frog friendly' for use near drains rivers and creeks".[5]

I have corresponded with both Nufarm Limited and the Australian Pesticides and Veterinary Medicines Authority (APVMA) regarding the verification authority for this claim, as it is improbable that frogs would find it particularly friendly, considering it is recommended that it should not contaminate streams, rivers or waterways, and that spray drift is a risk to plants.

The APVMA considers all glyphosate products registered for use in Australia as safe to use as instructed.

Of interest when considering our *Science Victoria* theme of human health in this month's issue. A suggestion by the World Health Organisation's Agency for Research on Cancer that Weedmaster DUO is "probably carcinogenic to humans" is refuted by the manufacturers, in favour of the opinion of Europe's food safety authority and chemicals agency and a US Agricultural Health Study.

The floods of November 2022 saw higher levels of pollutants in Melbourne's Maribyrnong River, however PFAS and microplastics are increasingly detected in many of our state's waterways.

This raises the question of whether we should rely on cancer health organisations or chemical agencies to ensure human health.

There have been recent reports of PFAS (per- and poly-fluoroalkyl substances) in a tributary of the Maribyrnong River, McLeod's Morass in the Gippsland Lakes, Hearts Morass from the RAAF Base East Sale, Bandiana Military Area, and HMAS Cerberus. Microplastics are approaching ubiquity: they are increasingly frequent in the food we purchase from the supermarket, and have now been found in human breast milk,6 human blood,[7] and in the air we breathe.[8] They are prevalent in marine food chains, with most aquatic ecosystems on Earth - and even Antarctic snow is now contaminated by microplastics.[9] We will focus on the subject of plastics in the August edition of *Science Victoria*.

Transparency, verification, and disclosure procedures are valuably becoming a more important part of determining social licence to operation for the corporate sector. The Australian Competition & Consumer Commission (ACCC) undertook an 'internet sweep' in 2022 and identified a range of environmental or sustainability claims of concern. The ACCC has since begun an investigation of a number of businesses for potential 'greenwash' and has a number of investigations underway.[10]

I invite readers to submit examples of 'greenwashing' that you are aware of.

We are now actively recruiting Organisational Members to the RSV. We welcome science and technology-based companies that wish to share ideas with others and support the RSV's mission. We also welcome discussion with non-profit organisations who may wish to affiliate with the RSV to enable 'science to speak with one voice' and to utilise our fine building.

Of course, first and foremost, we always welcome STEMM-minded individuals from all walks of life to join and engage with the RSV, and to support our goals and objectives.

Please email me any time at **president@rsv.org.au** with your thoughts, ideas, and responses to articles in *Science Victoria*.

Rob Gell
President, The Royal Society of Victoria

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Mitchell River silt jetties, at Gippsland Lakes Reserve.

HYDROGEN-POWERED HIGHWAYS: DECARBONISING ROAD TRANSPORT IN VICTORIA

By Geoffrey Drucker
Managing Director, Countrywide Hydrogen

Tasmania is providing a reference site for Victoria in delivering emissions reductions in two key areas: road transport and natural gas displacement.

While Tasmania is a discontiguous island state, Victoria is connected to the other Australian states and territories by road and rail. What this means is that transitioning heavy road transport from diesel to emission-free hydrogen for long distance and heavy payload transport will require an interstate network of hydrogen refuelling stations. However, in Tasmania, only three refuellers are required to cover the entire state, making it ideal to pilot major energy transitions.

Road transport contributes around 20% of Australia's emissions, but remains vital to connecting up our economy over our continent's vast distances between major settlements. The impact of these emissions on climate change are well known, but it's also their impact on health that is increasingly understood. New estimates by Melbourne Climate Futures Academy at the University of Melbourne released earlier this year show vehicle emissions may cause over 11,105 premature adult deaths, 12,210 cardiovascular hospitalisations, 6,840 respiratory hospitalisations, and 66,000 active asthma cases a year.[1]

Tasmania can demonstrate it is possible to reduce these emissions, while maintaining a road network, with Countrywide Hydrogen producing 5.4 tonnes of green hydrogen a day from the end of 2024, when fuel cell electric trucks will be available. Three renewable hydrogen production facilities with attached refuelling stations will be established in strategic locations near Hobart (at Brighton), Launceston (Western Junction) and Burnie (Heybridge), where transport hubs are already in play, with the prospect of growing as intermodals.

The production of green hydrogen will be split between decarbonising the state's natural gas network owned by Tas Gas, and refuelling heavy vehicles transporting goods and livestock throughout the state.

From there, we will extend our domestic hydrogen supply model onto the mainland, starting in Victoria. The starting point will be decarbonising transport between key provincial cities and Melbourne.

To do that, the Victorian Government needs to play a role. The state will be a beneficiary from such a roll-out, because every fossil fuel burning truck that is displaced by a zero-emission fuel cell truck will help the state achieve its emissions reduction targets.

What the Victorian Government can do is follow the lead of their counterparts in Tasmania and financially support the delivery of green hydrogen, by subsidising the cost of the renewable energy required for production as stated in the Tasmanian Renewable Hydrogen Action Plan.[2] The financial quantum of such a commitment is not significant, but the reductions in emissions are enormous.

The Victorian Government can also help by supporting research into the major transport corridors in the state that represent the greatest volumes of long-distance transport and resultant emissions. Having hydrogen production and refuelling at each end of these routes will incentivise the transition away from diesel. At the same time, the state's well-developed gas network can be de-carbonised, and industries offered 100% hydrogen as a heat source – which is also happening in Tasmania.

Corporate Australia also has emissions reductions targets and there is a strong push from major companies to encourage their road transport providers to offer a zero-emission logistics option from materials handling to trucks.

While emission-free battery electric vehicles will contribute to emissions reduction, it will be fuel cell electric trucks and buses that will have the greatest positive environmental impact. As an example, 7R Logistics is the first road transport company in Tasmania to subscribe to transitioning from diesel to hydrogen, which means their 12 prime movers servicing the dairy industry in the state will stop 3 million kilograms of harmful emissions each year.

Geoffrey Drucker
Managing Director, Countrywide Hydrogen

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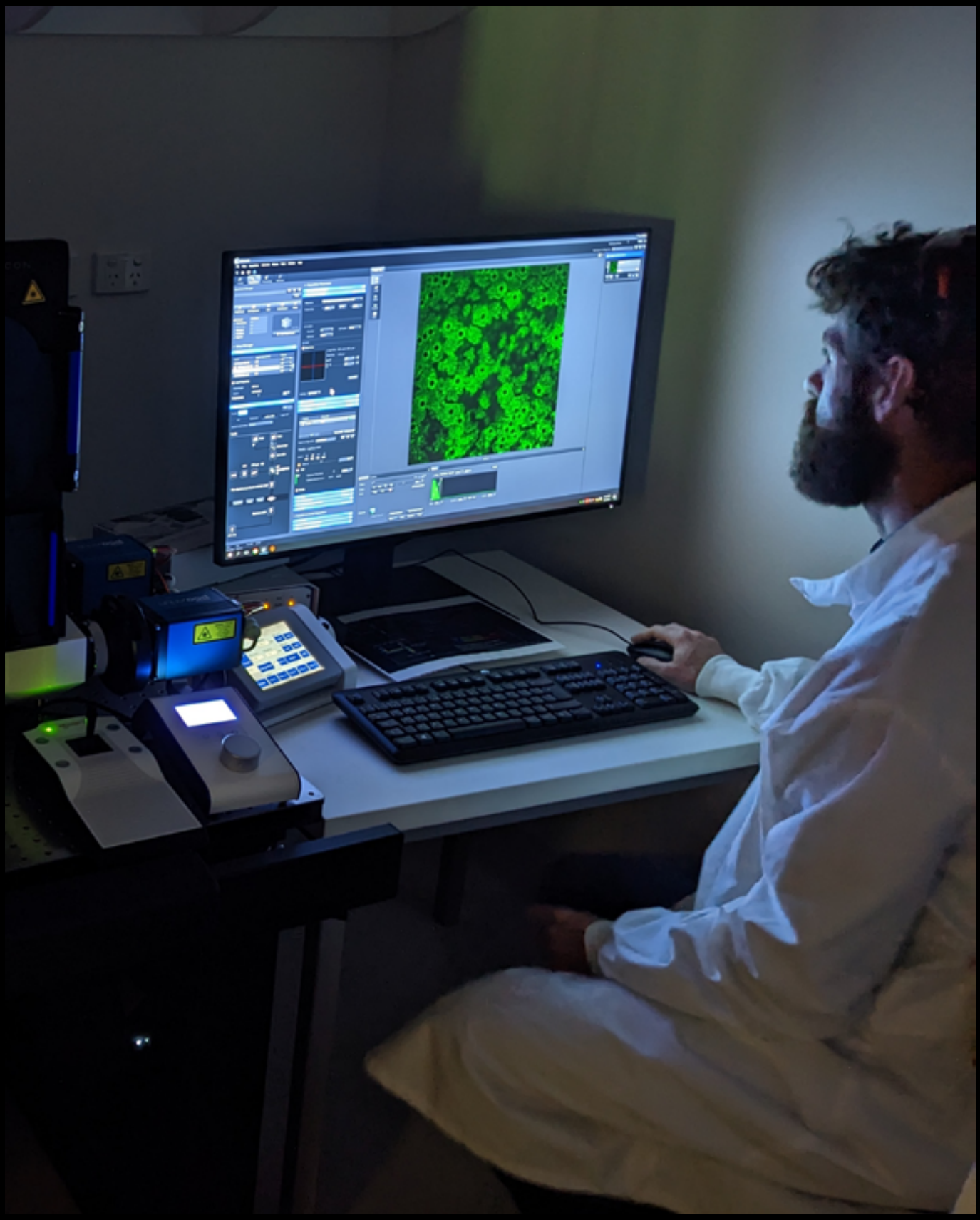
SNAPSHOTS OF STEMM

Images from everyday science.



Dr Darryl Johnson, Technical Support Officer at the University of Melbourne's Materials Characterisation and Fabrication Platform, using a Zeiss Elyra-7 Structured Illumination Microscopy (SIM) Super-Resolution Microscope. This microscope can differentiate objects separated by only 60 nanometres.

Photograph: Scott Reddiex/Royal Society of Victoria

SNAPSHOTS OF STEMM

Museums Victoria entomologist Ken Walker collecting moss in Great Otway National Park to search for Peloridiidae moss bugs.

Photograph: John Broomfield/Museums Victoria

SNAPSHOTS OF STEMM

Spark from a Van de Graaff generator, during a grade 2 science forces workshop at St Margaret's Berwick Grammar.

Photograph: Miss MaKayla Valenti, year 10 student/St Margaret's Berwick Grammar

NEW RSV MEMBERS

INDIVIDUAL MEMBERS

Ms Bronte Holt
Student, Monash University

Ms Cindy McLeish MP
Member for Eildon
Parliament of Victoria

Dr John Williams
Retired Agricultural Scientist & Agribusiness Consultant

Dr Ian Smith
Retired Climate Scientist

Ms Renee Nutbean
Sustainability Specialist

BECOME A MEMBER OF THE RSV

The Royal Society of Victoria is the State's oldest scientific society, a part of Australia's intellectual life since 1854. We bring together an independent community of science practitioners, educators, industrialists, and enthusiasts to promote an understanding and utilisation of scientific knowledge for the benefit of the state of Victoria.

OUR WORK

- Fostering, recognising, and rewarding excellent Victorian scientists across their career trajectory through awards and prizes
- Promoting understanding of science in the community
- Promoting science literacy and education so that people of all ages discover and understand the value of science
- Assisting and lobbying governments on issues relating to science and evidence-based decision making

MEMBERSHIP BENEFITS

- Fostering, recognising, and rewarding excellent Victorian scientists across their career trajectory through awards and prizes
- Promoting understanding of science in the community
- Promoting science literacy and education so that people of all ages discover and understand the value of science
- Assisting and lobbying governments on issues relating to science and evidence-based decision making

$40/YEAR

Student Membership

For students enrolled full-time at a recognised Victorian education and/or research institution (proof of current, full-time enrolment required for Student Membership commencement/renewal)

$120/YEAR

Full Membership

Open to all adults (18+) with an interest in science! A current membership of the Royal Society of Victorian entitles the use of the professional postnominal 'MRSV.' Those elected as Fellows of the Society are entitled to the postnominal 'FRSV.'

$1000/YEAR

Organisational Membership

For organisations to claim membership of the RSV. Provides a method for general sponsorship of the RSV's programs, along with discounted rates for access to RSV facilities throughout the year.

The Royal Society OF VICTORIA
Promoting science since 1854

To join the Royal Society of Victoria please go to **rsv.org.au/how-to-join**. You can also choose to support science in Victoria by completing the donation form in this edition or visiting **donorbox.org/royal-society-victoria**

GLACIERS & ICE SHEETS IN A WARMING WORLD

The 2023 A.W. Howitt Lecture | Presented by Professor Andrew Mackintosh, Monash University

Glaciers have experienced near-universal retreat during the last century. Mass loss from the massive ice sheets in Antarctica and Greenland is accelerating, and melting glaciers and ice sheets are now the largest contributor to sea level rise. Retreating glaciers also threaten water supplies, and are linked to mountain hazards.

While ice seems distant to us in Australia, a 2014 report by the Climate Council indicated that $226 billion dollars of our infrastructure is located within 1.1 m of sea level and is at risk of inundation by the end of this century under high-emission climate change scenarios – with ice melt being a major source of risk. Globally, sea level rise poses an existential risk to low-lying islands, major deltas, and coastal megacities. The science of glaciology is far from settled – our ability to measure and simulate how ice is changing has improved dramatically – but future predictions of glacier and ice sheet contributions to sea level change remain challenging.

Join Professor Andrew Mackintosh, who will describe his research group's work to reconstruct past glacier and ice sheet changes and improve predictions, illustrated with field work photos and video from the Southern Alps of New Zealand and Antarctica.

ABOUT THE SPEAKER

Professor Andrew Mackintosh is Head of the School of Earth, Atmosphere and Environment at Monash University, and is a Chief Investigator of the Australian Research Council Special Research Initiative 'Securing Antarctica's Environmental Future.' His research aims to improve our understanding of glacier and ice sheet response to climate change, including assessing the impacts on sea level, water resources and ecosystems. He is a regular commentator in the media and was a Lead Author of the IPCC Special Report on the Oceans and Cryosphere in Changing Climate published in 2019. Andrew's work has taken him to the world's major mountain ranges as well as the ice sheets of Antarctica and Greenland. He has a PhD from the University of Edinburgh, a post-doc from Utrecht University, and he has held visiting positions at Columbia University and The University of Bristol. Prior to Monash, he was Director of the Antarctic Research Centre in Wellington, New Zealand.

The annual A. W. Howitt Lecture is a joint presentation between the Geological Society of Australia (Victoria Division) and the Royal Society of Victoria, commemorating the contributions made to regional natural history and geology by Alfred William Howitt.

The Royal Society OF VICTORIA
Promoting science since 1854

GEOLOGICAL SOCIETY OF AUSTRALIA

GLACIERS & ICE SHEETS IN A WARMING WORLD

Date/Time:
Thursday, 22 June 2023, 6pm

Price:
In-Person: $10 (non-members)/$5 (RSV/GSAV members)
Online: $5 (non-members)/Free for (RSV/GSAV members)

Location:
The Royal Society of Victoria
Wurundjeri Country
8 La Trobe Street, Melbourne
(Simulcast on Zoom)

Reserve your spot at:
rsv.org.au/events/glaciers-ice-sheets/

Inspiring Australia Victoria

Presented as part of the Inspiring Victoria program in 2023


KANGAROOS
NEXT
14 km

DECOLONISING FIRE SCIENCE

Presented by Dr Philip Zylstra, Curtin University.

We can expect that the science of fire should intersect with fire use by First Peoples, because an understanding of fire that enabled cultures to coexist with it for at least 65,000 years must have its roots in scientific reality. Our understanding of that relationship is, however, deeply troubled.

The predominant concepts of modern fire science arise from a paradigm that valorises the role of human agency, dismissing and even demonising natural ecological processes. The result is that fire science has become a tool with which Indigenous fire knowledge is reinterpreted to support the colonial narrative and reinforce pseudo-science in a loop of circular reasoning. The implications of this are far-reaching, and poor fire science now drives management that decimates carbon storage, threatens the existence of numerous species, and drives much of the impact of bushfire on human society.

Join ecologist and environmental scientist Dr Philip Zylstra, who will examine the roots of this dilemma and give examples of it in the current context, then demonstrate how the narrative is reversed when we adopt an understanding of fire that is informed by ecological processes, interpreted within a sound mechanistic framework. Using the Fire Research and Modelling Environment (FRaME), Philip will introduce Ecological Control Theory, showing how forests limited the impacts of fire and maintained thriving populations of fire-sensitive species long before the arrival of humans.

Finally, he will demonstrate how a paradigm of cooperation rather than domination allowed for the long-term coexistence with fire demonstrated by First Peoples, and the ways that we can adjust our current approaches to cooperate with Country.

ABOUT THE SPEAKER

Dr Philip Zylstra came into bushfire research from a background in fire management and remote area firefighting. Since that time he has developed the first and only peer-reviewed fire behaviour model for most Australian forests, as well as the first model globally to calculate the direct effects of fire on flora, fauna and soils. His work focuses on understanding the ways that our interaction with forests affect fire risk. Using fire history analysis and state-of-the-art modelling, Phil's work reconciles deep knowledge from First Peoples with forest ecology and a complex understanding of fire behaviour to provide critically-needed guidance in fire management.

Phil is an Adjunct Associate Professor with Curtin University's School of Molecular and Life Sciences (Perth), and a Research Associate of the University of New South Wales (Sydney).

Presented as part of the Inspiring Victoria program in 2023

Inspiring Australia Victoria

DECOLONISING FIRE SCIENCE

Date/Time:
Thursday, 13 July 2023, 6pm

Price:
In-Person: $10 (non-members)/$5 (RSV/GSAV members)
Online: $5 (non-members)/Free for (RSV/GSAV members)

Location:
The Royal Society of Victoria
Wurundjeri Country
8 La Trobe Street, Melbourne
(Simulcast on Zoom)

Reserve your spot at:
rsv.org.au/events/decolonising-fire-science/

THE STEM CAREER PATHWAYS SURVEY

If you've ever thought about leaving the sector, why was that - and what made you stay? Has your career in STEM been planned – or largely improvised?

We need you to share your experiences to create Australia's biggest survey on STEM Career Pathways. The STEM Career Pathways survey (**research.net/r/STEM_Career_Survey**) will be Australia's most comprehensive snapshot of current conditions and career patterns for scientists, technologists, mathematicians and engineers.

We also need to hear from people who have left STEM careers – to know more about why they left. The study will gather crucial information on workloads, conditions, career development and opportunities for people to move between industry and research across Australia's STEM sector.
This survey is being run by Science & Technology Australia (**scienceandtechnologyaustralia.org.au**) to gather updated evidence on STEM career pathways and movement across the sector.

It will inform research commissioned by the Office of the Chief Scientist (**chiefscientist.gov.au**) for the Prime Minister's National Science and Technology Council (**chiefscientist.gov.au/national-science-and-technology-council**).

The survey takes around 10 minutes to complete. It is open to anyone with a STEM qualification and you can respond anonymously. All survey participants can enter the draw to win one of two $500 JB HiFi vouchers. The entry form is at the end of the survey.

The survey is open now at **research.net/r/STEM_Career_Survey** and closes on **14 June 2023**.

NATIONAL YOUTH SCIENCE FORUM 2024

Are you a Year 11 student passionate about science, technology, engineering and maths (STEM)?

Do you want to meet like-minded young people from across Australia? Do you want to learn more about your study and career options?

Apply for the 2024 National Youth Science Forum (NYSF) Year 12 Program!

The NYSF Year 12 Program is designed to give students a broader understanding of the diverse study and career options available in science, technology, engineering and mathematics (STEM) and to encourage continued studies in these fields.

The NYSF Year 12 Program runs two summer sessions. Participants stay at university colleges and are immersed in science and technology.

Delivered by youth for youth, past participants are selected to return each year to participate in the Student Staff Leadership Program and help run the program the year after they first attend. More information about the program, including the application process, fees, and financial support, can be found on our website.

If you have any questions at all, please don't hesitate to contact us at **nysf@nysf.edu.au**.

We are excited to welcome students from Victoria to the National Youth Science Forum in January 2024!

Locations:
The Australian National University, Canberra (5-13 January 2024) & The University of Queensland, Brisbane (12-20 January 2024)

Applications are open now at **nysf.edu.au/programs/year-12-program/**

Applications close **31 July 2023**.

THE LOST CITY OF MELBOURNE

An event organised by Geography Victoria – auspiced by The Royal Society of Victoria

Geography Victoria events are open to everyone. Our recent events at the Port of Melbourne and the coastal field trip at Sandringham and Beaumaris have sold out quickly. Following on from the successful Geography Victoria's Christmas Treasure Hunts in December 2022, we are off in search of more treasures of Melbourne. This time we will be inside, discovering...

THE LOST CITY OF MELBOURNE

In the 1850s, Melbourne was the fastest growing city in the world. "They dreamt big, they built big....it was a city jumping out of its skin".

Melbourne became an epicentre of film and culture, and its hotels, restaurants, and cafes became world renowned. However, the attempted 'modernisation' of Melbourne in the 1950s destroyed much of the city, including its elegant cinemas and picture palaces. Buildings were deemed too Victorian, the opposite of a modern metropolis, and Whelan the Wrecker's (**en.wikipedia.org/wiki/Whelan_the_Wrecker**) demolition blitz began.

Featuring rare archival film & photography, this film is a revelatory work that allows its audience to reimagine the former glory of the lost city of Melbourne.

Director & Producer Gus Berger is a Melbourne based filmmaker and owner/operator of Thornbury Picture House, a lively independent art-house venue.

Watch the trailer at: **www.thelostcityofmelbourne.org**

THE LOST CITY OF MELBOURNE

Date/Time:
Sunday 23 July 2023, 3pm - 5.30pm (screening from 3pm, light refreshments from 4.40pm)

Price:
$25 (+ booking fee)

Location:
Thornbury Picture House
802 High Street
Thornbury

Book your ticket at:
rsv.org.au/events/lost-city-of-melbourne/

Applications close at **5pm AEST on Monday, 12 June 2023**.

For more information, and to apply, visit **veski.org.au/stem-sidebyside-mid-career-emerging-leaders**

veski inspiring women STEM sidebyside program

Applications are now open for the veski inspiring women STEM sidebyside program in 2023.

The veski inspiring women STEM sidebyside program was established in 2018 and is proudly delivered by veski.

The dynamic program of workshops and networking opportunities is designed to empower women at different career stages with the skills, networks and mindset to develop and achieve their career goals.

With women continuing to be under-represented at leadership levels across Australia, the veski inspiring women STEM sidebyside mid-career leaders program goes some way to addressing this challenge, and is designed to support women wanting to progress or extend into leadership positions within a STEM industry enabling them to better foster and generate organisational cultural change and pave the way for future generations.

UPCOMING RSV EVENTS

The RSV hosts many STEMM-related events, public lectures, and meetings throughout the year. These are predominantly held at the RSV Building at 8 Latrobe St, Melbourne (unless otherwise indicated), and simulcast online via YouTube/Facebook Live. Our public lectures comprise the "Scientists in Focus" component of the Inspiring Victoria program in 2023.

22 JUNE

A. W. HOWITT LECTURE 2023: GLACIERS & ICE SHEETS IN A WARMING WORLD

Prof Andrew Mackintosh from Monash University will discuss the retreat of glaciers, the accelerating mass loss from ice sheets in Antarctica and Greenland, and the implications for sea level rise, water supplies, and coastal areas, highlighting the need for improved understanding and predictions in glaciology to address these challenges.

The A.W. Howitt Lecture is a joint Meeting and Public Lecture with the Geological Society of Australia, Victoria Division.

Reserve your spot at: **rsv.org.au/events/glaciers-ice-sheets/**

7 JULY

SEMINAR: CREATING A SUSTAINABLE FUTURE WITH GREEN CHEMISTRY

A joint meeting with Monash University's School of Chemistry

Featuring Professors John Warner & Paul Anastas (USA), co-authors of "Green Chemistry: Theory & Practice" (ISBN: 9780198506980, Oxford University Press, 1998)

13 JULY

SEMINAR: DECOLONISING FIRE SCIENCE

Dr. Philip Zylstra from Curtin University will discuss the problems of modern fire science, which is dismissive of Indigenous fire knowledge and ecological processes, resulting in detrimental management practices. Dr. Zylstra proposes an alternative approach that embraces cooperation and ecological understanding to coexist with fire in a sustainable manner.

Join us in person or via Zoom webinar on Thursday, **13 July** from 6:00pm.

Reserve your spot at: **rsv.org.au/events/decolonising-fire-science/**.

17 AUGUST

YOUNG SCIENTIST RESEARCH PRIZES

Finalists of the RSV's annual Young Scientist Research Prizes will present their work and the winners announced at this event in August.

For more information, visit **rsv.org.au/awards-and-prizes/young-scientist-research-prizes/**

12 OCTOBER

RSV + AATE MEETING & PUBLIC LECTURE

Joint Meeting and Public Lecture with the Australian Academy of Technology and Engineering

23 NOVEMBER

PHILLIP LAW POSTDOCTORAL AWARD LECTURE

The winner of the RSV's Phillip Law Postdoctoral Award will present their work to a special meeting of the RSV at a public lecture scheduled for the evening of Thursday, **23 November 2023**. This will be professionally filmed and shared online.

For more information, visit **rsv.org.au/awards-and-prizes/phillip-law-award/**

7 DECEMBER

RSV RESEARCH MEDALLIST LECTURE

The winner of the annual RSV Medal for Excellence in Scientific Research will present a lecture to RSV members and guests on the evening of **Thursday, 7th December 2023**, at which the Medal will be presented.

For more information visit **rsv.org.au/awards-and-prizes/research-medal/**

THE PHILLIP LAW POSTDOCTORAL AWARD

This award was made possible from the generous bequest to the Society from the estate of the late Dr Phillip Garth Law AC, recognising excellence in scientific research by an Early Career Researcher within seven years of attaining a doctoral qualification from a university in the State of Victoria, Australia.

In 2023, the award is open to suitably qualified post-doctoral candidates in Category IV: Biological Sciences (non-human). This category incorporates Agriculture, Biochemistry, Botany, Cell Biology, Ecology, Forestry, Zoology, and related areas of non-human biological science.

ELIGIBILITY:
Application is open to candidates within seven years (at the deadline of application) of the awarding of their doctorate from a university in the State of Victoria, Australia. Applicants must either be an Australian Citizen or have Australian Resident Status. The Society will consider adjusting the seven year window for candidates who have spent time working as primary carers following their PhD - if this applies to you, please contact the Society to discuss your eligibility.

APPLICATIONS:
Open on **1 June 2023** and close at **5pm, 31 July 2023**.

Candidates should nominate themselves. The application should consist of:

- A brief **Curriculum Vitae** (no more than four A4 pages) including full contact details of the applicant.
- **Proof of citizenship or residency status** (a copy of the applicant's birth certificate, citizenship certificate or certificate of permanent residency status).
- A statement (up to three A4 pages) summarising the applicant's **research contribution** and including the names and contact details of two referees.
- **A list of publications in peer reviewed journals.** For multi-authored publications, the contribution of each author should be indicated.

SUBMISSION:
Should be in the form of a single PDF file sent via email and marked for the attention of the Chief Executive Officer at rsv@rsv.org.au.

CONDITIONS:
The Royal Society of Victoria reserves the right not to consider applications which do not comply with the above requirements and the right not to make an award if no suitable candidate applies.

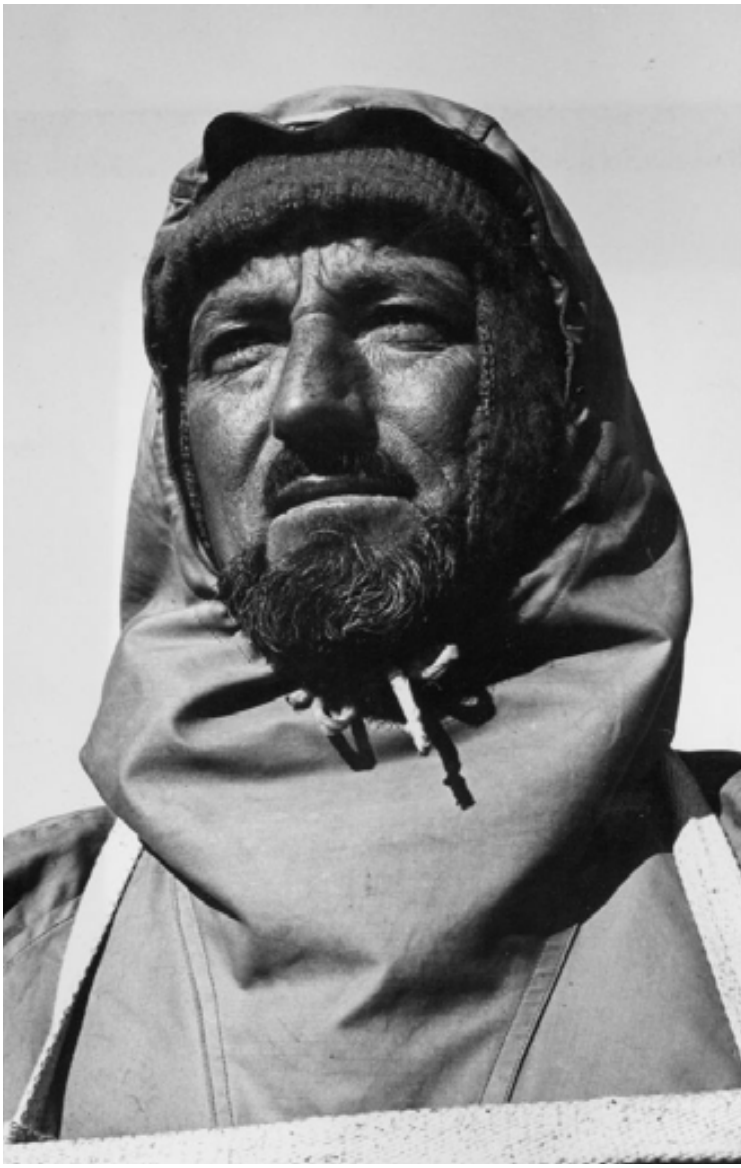
THE AWARD:
The successful candidate will receive an award certificate and a prize of AUD$3,000.

THE PHILLIP LAW POSTDOCTORAL LECTURE:
The winner will be required to present their work to a special meeting of the Royal Society of Victoria at a public lecture scheduled for the evening **Thursday, 23 November 2023**. This will be professionally filmed and shared online. If COVID-19 conditions prevent the event from proceeding, then the prize winner will deliver a pre-recorded, 45 minute talk on their research, ideally to be professionally filmed at the RSV's headquarters, then join an online meeting of the Royal Society of Victoria and guests for the screening and subsequent discussion.

Please note that the Society does not pay travel expenses to Melbourne for the purpose of filming or presenting the lecture.

ENQUIRIES:
Chief Executive Officer, The Royal Society of Victoria, 8 La Trobe Street, Melbourne 3000

Telephone: (03) 9663 5259. Email: **rsv@rsv.org.au**.



Dr Phillip Garth Law, Leader of the Australian National Antarctic Research Expeditions from 1949, pictured circa 1956 in Antarctica. Dr Law was the President of the Royal Society of Victoria from 1967-69, during which time he led the Society's efforts to establish the Victorian Institute of Marine Sciences.

RSV MEDAL FOR EXCELLENCE IN SCIENTIFIC RESEARCH 2023

Nominations are invited for the RSV Medal for Excellence in Scientific Research. In 2023, this award will recognise excellence in Category III: Earth Sciences.

The Earth Science Category includes research undertaken in the disciplines of Geology, Geochemistry, Geochronology, Geophysics, Planetary Physics, Meteorology, Oceanography, Physical Geography, Palaeontology and related sciences.

In its centenary year (1959), the Royal Society of Victoria instituted a Medal for Excellence in Scientific Research. The Award consists of a Silver Medal, which is awarded annually for scientific research in one of four categories (rotating each year).

The award of the Medal is based on demonstration of the candidate's excellence and leadership in scientific research. The candidate's research work shall have been carried out in or on Australia (including its territories), with preference for work done in or on Victoria.

Nominations close **31 July 2023**

For more information, including criteria and details on how to nominate, visit **rsv.org.au/awards-and-prizes/research-medal/**

Right: 2022 RSV Medallist Prof Rachelle Buchbinder accepting the prize from Nobel Laureate Prof Peter Doherty AC

ELEVATE: BOOSTING WOMEN IN STEM

Applications for the Australian Academy of Technological Sciences & Engineering's Elevate: Boosting Women in STEM Program commencing in 2024 are currently open.

The Elevate: Boosting Women in STEM program will award up to 500 undergraduate and postgraduate scholarships to women in STEM. The program aims to address gender inequities in STEM through fostering more women-led industry-academia collaborations in applied research and business, growing professional skills of women in STEM, and propelling women into leadership.

The Elevate program provides:
- A scholarship
- Access to events and networking
- Mentoring
- Ongoing support during scholars' university studies

Applicants are required to meet three eligibility criteria:
- Identify as a woman or non-binary person
- Be enrolling as a domestic student
- Be planning to undertake a STEM degree or higher studies to improve business acumen at an Australian university, commencing in 2024

Applications for the 2024 Elevate program close at 5:00pm (AEST) **31 August 2023**.

For more information, including application and eligibility guidelines, visit **atse.org.au/career-pathways/elevate/**

HEALTHY HABITATS: RETHINKING URBAN DESIGN FOR ENVIRONMENTAL AND HUMAN HEALTH

By Dr Ross Wissing

The 16th of May 2023 was the 30th birthday of WaterWatch (**vic.waterwatch.org.au**). I tuned into The Past, Present and Future of WaterWatch panel discussion, a program that is close to my heart as it was where I cut my teeth in natural resource management.

My decade working in WaterWatch showed me how to help local communities work with natural resource managers to learn about, understand, and improve the health of their local waterways. Government funding as a holistic program ceased around 2009. Some of the current key issues highlighted during the discussion were the same we encountered, and to a large extent resolved, when there was adequate Commonwealth, State, and local financial support. Many of the mistakes, and lessons learned, in the past have unfortunately been forgotten and are now being repeated.

Over three decades of water monitoring shows that our waterways are degraded and worsening.[1] Almost half the basins in Victoria have less than 10% of their major rivers and tributaries in good or excellent condition.[2] A central message of WaterWatch was establishing the association between the health of people and the health of their waterways and catchments. I don't know how many times I mentioned the phrase "wetlands are nature's kidneys" to kids. Yet while WaterWatch was able to actively engage students and adult rural landholders, we gained little traction with urban adults.

ENGAGING ADULTS IN URBAN ENVIRONMENTAL MANAGEMENT

Understanding the problem of engaging urban adults was a question I continued to ponder as I moved into urban planning, and a key motivation for me commencing a PhD in 2012.[3] Initially, this meant understanding that although adult participation in urban public land management was low, around 70% of our cities are owned, designed, and managed by private residents.[4] Home gardens are therefore the most dominant and accessible form of 'nature' in our cities. Home is also where two thirds of the average Australian's ecofootprint is generated and/or consumed. However, once residential areas are built, governments have few levers available to influence how residents design and use their land. Further, there is generally very little understanding by urban planners about how residents design, use, and maintain residential properties, what motivates them, and why Australians overwhelmingly continue to want to live in low-density areas.

EVEN LESS IS KNOWN ABOUT THE HISTORIC REASONS FOR AUSTRALIAN SUBURBS.

Australia's low-density suburbs emerged because of problems that the early British colonisers had growing food. Many crops failed. In response, Governor Phillip decreed that town blocks in Sydney be 'a quarter acre' (~1000 m2) so that individual residents could grow their own food and treat their own waste. By the 1830's many British migrants to what is now Victoria were the urban poor, escaping widespread pollution, cramped and unhealthy living conditions. At this time English urban dwellers had half the life expectancy of their rural counterparts. Experiencing such intolerable conditions in cities like London, Manchester, and Liverpool led to the establishment in England of the 1833 Select Committee of Public Walks, and the creation of public parks for the urban poor. Such lived experience heavily influenced the extensive public park network in Melbourne and Geelong that underpin international recognition of 'liveability'. Immense wealth from the 1850 gold rush enabled many immigrants to buy large suburban blocks, helping to establish Australia's high private home ownership culture.

Central to creating Melbourne's private and public landscape was a collaborative approach between public health and what would become in the early 20th century, town planning. Understanding the interconnected relationship between the built environment and human health has a long history in Western society, dating to at least Hippocrates (460-370 BC), the 'father of medicine' and the author of On Airs, Waters and Places. Such interconnected relationships existed for tens of millennia longer for our First Nations people, so eloquently expressed in the concept of Country and the notion that the health of Country and health of people are inextricably linked. Aboriginal Australians have planned, designed, curated, and managed the Australian land and sea for at least 60,000 years and probably over 100,000.[5] They are the world's oldest landscape architects.

The landscape 'template' consciously established by our First Nations people created the 'parks' that many early British explorers and settlers effused about. Many commented on the fine health of Aboriginal people and settlements, with numerous references to their neighbourhoods, hamlets, villages, and towns. Only now is mainstream Australia appreciating and seeking to learn from this.

MANAGING URBAN SPRAWL

Since the beginning of the 'environmental era' around 1970, Australian urban policy has identified medium and high-density dwelling, including infill, as the most sustainable response to 'urban sprawl'. A few Australian urban scholars, especially Hugh Stretton, continued to advocate for retaining low-density urban living to enable resident sustainability, amid recognition that the home economy provided up to half of GDP.

Today, research suggests that few aspects of medium-high density living are more sustainable than low density suburbs. In fact, human society worldwide has overwhelmingly evolved to,

and lived-in, low-density settlements. When the British arrived in Australia, around 3% of the world's population lived in cities.[6] Today this is 50%, and projected to reach 70% by 2050.[7] Conditions in many cities across the world appear headed back towards the British ones of the early 19th century. The heat island effect, first recognised in England between 1806 and 1830, is increasingly prominent.[8] Recent projections in western Sydney suggest that by 2090 there will be over 60 days per year where temperatures exceed 35oC.[9] An outcome of increasing density to medium and high levels is reduced existing tree cover and increased hard surfaces. This increases the urban heat effect as well as the impacts of storm events (and resultant stormwater and waterway pollution) and declining soil health. Even before the COVID-19 pandemic, a Victorian counter-urbanisation movement was emerging with lifestyle (73%) and natural environment (61%) the main motivators.[10]

The notion of 'urban sprawl' is largely undefined. This article follows the The Suburban Reader definition of 'excessive growth expressed as careless, awkward, unsustainable use of land', rather than low density living.[11] Australian conceptions of urban sprawl are largely borrowed from American ones, where the 'aesthetic' appearance is the dominant design characteristic with very little consideration of adequately sized residential land to sustainably meet basic human needs within its ongoing ecological capacity. Yet in Australia, the suburbs arose initially from utilitarian needs, with a more balanced focus including ornamental features prevalent for a century from the 1860s. Since the 1970s the ornamental/visual has increasingly dominated the design of Australian landscape.

DESIGNING HEALTHY URBAN LANDSCAPES FOR ENVIRONMENT AND PEOPLE

When starting my PhD there was little agreement, understanding, or definition of a 'sustainable landscape' in the Australian context. A range of broader green design and sustainable infrastructure assessment frameworks were available, but linkages to the landscape and/or green infrastructure were limited. While such targets have since been incorporated, they remain broad and provide few spatial metrics required to enable sustainable environmental or human health. Those included, such as 40% tree cover,[12] now appear to be at least half that required to mitigate urban heat.[13] Little research has also attempted to correlate the size of private green space with its use, meaning and impact. Even less linkages exist between landscape health and the broader determinants of human health. Providing these spatial metrics, or rules of thumb, for residential landscapes was a key outcome of my research.

While Australians are living longer, the type of disease burden has changed. Lifestyle diseases dominate. Around two thirds of Australians are overweight or obese, 73% do not meet physical activity guidelines, and almost 95% do not eat the required amount of fruit and vegetables.[14] Over 80% of lifestyle diseases are affected by modifiable environmental factors,[15] yet the current approach is overwhelmingly targeted towards behavioural change, especially changing habits. Although the influence of the physical built environment is acknowledged, it is often given at best equal weighting with social determinants of health. This is despite recognition by the WHO that human health is dependent on the health of the environment.

Many of Australia's lifestyle diseases have long gestation periods, often decades. The overwhelming current medical approach to addressing these issues are 'curative' and pharmaceutically focused when people present with symptoms. Only around 2% of the health budget is focused on preventative approaches, despite recent Victorian evidence showing a return on investment of $14.30 for every $1 invested in prevention.[16] Similar extraordinarily low levels of investment in prevention and resilience exist in addressing climate change.[17] While influencing habits is important, most approaches focus on individual characteristics such as values, rather than more influential factors such as personality traits. Further the physical places where people live, and undertake activities, have critical antecedent influences on individual behaviour. Residents have a much stronger capacity to change their private spaces, but very limited influence in the public realm.

The importance of outdoor green spaces, including private gardens, local streets, and public open space, were highlighted during COVID-19. A national survey undertaken in 2020 and 2021 by Macquarie University found that Australians who engaged in activities including gardening, nature connection and recreation in both public and private outdoor spaces had improved mental health, although there were several significant age and gender effects. This research highlights that human needs provided by private and public green spaces are different but complementary and cannot be substituted. Importantly,

RECOMMENDATIONS:

An immediate policy and budgetary shift to preventative approaches focused on working with, rather than against, ecological and human nature.

Formally incorporating learnings from First Nations approaches to landscape planning, design and management in a constantly changing climate.

Establish contemporary, statutory scientific based spatial targets within the Victorian Planning Scheme to ensure sustainable healthy landscapes for the environment and people.

gardening is regularly undertaken by over 80% of Australians, in contrast to the most popular form of public recreation, walking, in which around 40% of Australians regularly participate.

Housing, which accounts for 20% of the Victorian ecofootprint, provides one basic human need of shelter. Medium-high density housing does not address the broader range of basic needs required for human well-being that the average Australian backyard provides. This includes food production, which comprises 30-40% of the ecofootprint and thermal comfort (especially shade), clean water, green waste management, water storage, soil health, carbon sequestration and physical and mental health. Further, Australian houses today are four times larger than the 1950s per capita and often account for 80% of the residential block, compared to less than 30% in the 1950s.[18]

Melbourne, like most Australian cities, was selected because of its comparatively rich soils and reasonably reliable supply of fresh water. In their current low-density state, these soils can still provide an adequate substrate for residents to grow most vegetable and fruit diet needs. Food production was a defining characteristic of Australian suburbs until well after World War II as food represented around 40% of living expenses.[19] Research suggests that the time required to achieve vegetable and fruit home self-sufficiency is the same amount of moderate physical activity to meet physical health needs.

A WAY FORWARD?

The current housing crisis, combined with enduring impacts of a changing climate and COVID-19 raise questions about how urban landscapes are planned and designed to prevent, mitigate, and adapt to such changes while sustainably achieving environmental and human health. To this end, I have recently established a range of physical and psychological health indicators and the associated physical landscape requirements needed to sustainably design public landscapes where the government still has significant direct influence. However, much broader conversations are needed, with perhaps the Restorative Commons: Creating Health and Well-being through Urban Landscapes convened by health, design, and urban natural resource managers in New York in 2007 providing a suitable template.

Dr Ross Wissing works between academia and practice. Geelong/Djillang based, he is Managing Director of Tabayl (meaning Country or ground, in Wadawurrung language), a consulting firm that works with ecological and human nature to create healthy, sustainable landscapes. He collaborates closely with The Connective to enhance nature connection benefits of landscapes.

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MELBOURNE'S URBAN WATERWAYS: PAST, PRESENT AND FUTURE

By Dr Don Williams MRSV

Melbourne's urban waterways provide a welcome contrast to an otherwise seemingly endless cityscape. Despite the changes that occurred after European settlement, these waterways still contain remnant ecosystems, which faintly echo the diversity they once displayed.

In addition to their contribution to the city's environmental values, urban waterways also provide important social, economic, and aesthetic benefits. This article examines how science informs our understanding of how urban waterways have deteriorated and can guide efforts to protect and restore them.

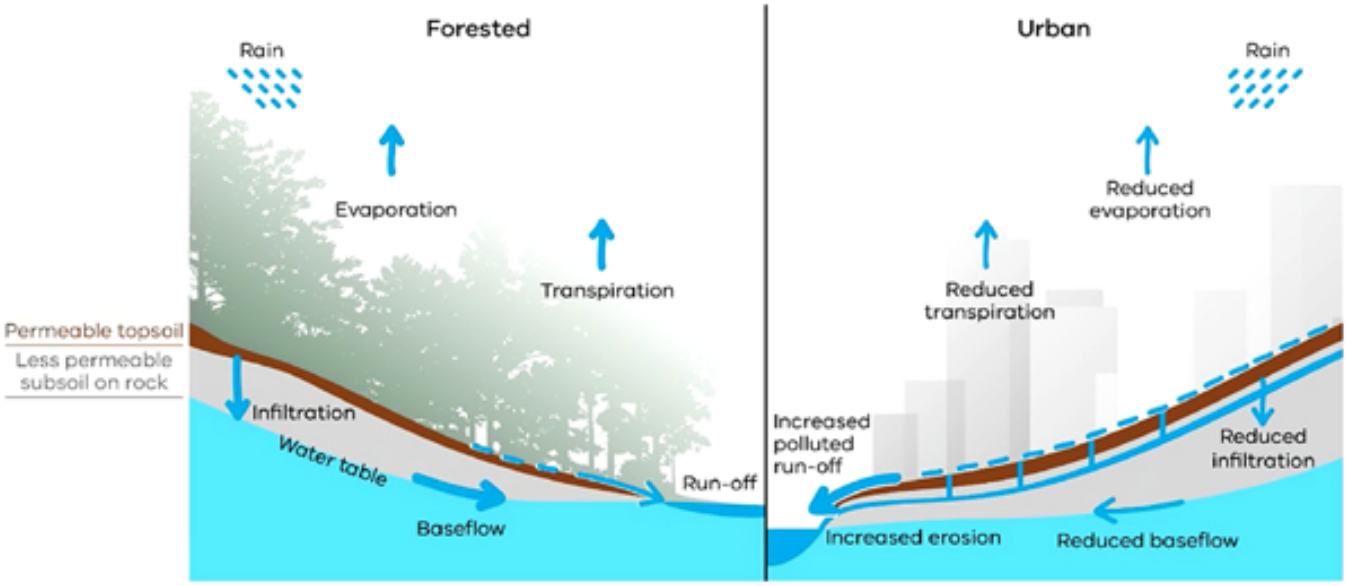
The article focuses on waterways in the Melbourne metropolitan area and does not consider wetlands and estuaries. The Port Phillip and Western Port regions (Werribee, Maribyrnong, Yarra, Dandenong, and Westernport catchments) include 8,400 kilometres of waterways, of which more than 2,000 kilometres are affected by stormwater runoff from Melbourne's built-up area.[1]

In this article, 'urban stormwater' is water that runs off surfaces such as roads, roofs, and paved areas to stormwater drains. Drainage systems collect and discharge stormwater to surface waters, including rivers, creeks, lakes, estuaries, and the ocean. In Australia, polluted wastewater from households (toilets, bathrooms, kitchens) and industry is directed to a separate sewerage system. Wastewater is no longer discharged to Melbourne's waterways.

THE PAST: PRE-EUROPEAN CONDITION OF MELBOURNE'S WATERWAYS

Before European settlement, Melbourne's urban waterways were fed by runoff from catchments clad in natural vegetation. In these catchments, most rainfall that did not evaporate infiltrated the soil surface and entered streams by two processes: either via shallow pathways in permeable topsoil, or by percolation to groundwater, which released 'baseflows' to streams (baseflows are the sustained flows in streams during dry weather). Vegetation slowed the flow of rainfall across the soil surface and encouraged infiltration. Overland flows only reached

Above: Moonee Ponds Creek, and Below: First Stage of the Restoration Project at Strathmore (Images: Don WIlliams)



Comparison of the Water Cycle in Forested and Urbanised Catchments (Source: Stormwater Strategy November 2013, Melbourne Water Corporation)

streams after particularly large storms (which only occur on a few percent of days) and were a minor pathway for rainfall to enter streams. Collectively, these mechanisms moderated peak inflows to streams after rainfall and maintained baseflows during dry periods.[2] This natural hydrologic cycle slowed erosion.

Adjoining vegetation shaded waterways and stream beds and banks had not been subject to the massive physical modifications that occurred after European settlement.

These natural catchment and waterway conditions supported rich and diverse ecosystems. However, this changed abruptly after the foundation of Melbourne in 1835.

THE PRESENT

Melbourne's astonishing growth from 1835 to the present has utterly transformed the city's catchments and waterways. Continued urban development has led to thousands of square kilometres being stripped of vegetation and replaced by impermeable surfaces including roads, roofs, and paved areas. Formerly extensive wetlands have been drained. The ever-present drive to maximise the area of land available for development, combined with efforts to control flooding, have led to enormous physical modification of streams, which have often been converted to concrete-lined drains and, in the most extreme cases, been buried underground.

These changes to catchments and streams have completely transformed the conditions for waterway ecosystems. Urban streams are stressed by changed hydrologic regimes, increased pollutant loads and changed physical form.

Stormwater runoff from the impervious surfaces prevalent in urban areas is efficiently captured by drainage systems and quickly discharged to streams. This leads to frequent high flows in streams, after even modest rainfall. However, catchment infiltration is greatly reduced and baseflows are much smaller. Overall, stream hydrology is drastically changed, with more frequent and higher peak flows after rainfall, but much reduced baseflows. The enhanced peak flows exacerbate erosion and efficiently transport sediment to waterways.[2]

Stormwater from urban catchments includes pollutants such as suspended solids (i.e., solid particles suspended in the water column); metals, hydrocarbons and rubber shed from vehicles to roadways; detergents from vehicle washing; and fertilisers and herbicides from gardens. The suspended solids in urban runoff strongly bind pollutants such as metals and petroleum hydrocarbons and convey them to waterways.[2,3]

The physical form of many urban streams has been greatly altered by engineering works, which can involve straightening and deepening of stream channels; replacing natural materials in beds and banks with hard impervious substances, such as concrete and rock armouring; and placing smaller streams in buried stormwater drains.

The changed hydrologic regime, increased sediment and pollutant inputs and altered physical conditions have, unsurprisingly, led to dramatic declines in the health of waterway ecosystems with, for example, macroinvertebrate communities in urbanised streams being reduced to a few tolerant taxa.[4]

In 1999, Victoria introduced some controls on the quality of stormwater discharged from urban development, based on scientific knowledge obtained in many countries, including Australia.[5,6] These controls focus on reducing the loads of suspended solids, phosphorus, and nitrogen in stormwater runoff (mandatory annual load reductions: at least 80% for suspended solids and at least 45% for both total phosphorus and total nitrogen).

Suspended solids harm aquatic ecosystems by reducing light transmission, smothering habitats, and carrying pollutants into waterways, meaning that reducing the quantity of solids entering waterways is a positive step. Reducing phosphorus and nitrogen loads in urban stormwater helps to reduce the risks of excessive algal growth in inland waterways and Port Phillip Bay (which receives stormwater runoff from Melbourne), respectively.[7]

While acknowledging the benefits of these controls, research shows that more comprehensive measures are needed to improve the protection of Melbourne's urban waterways.[2]

THE FUTURE

Melbourne's population continues to increase extraordinarily quickly, inevitably leading to further urbanisation of the city's catchments. Continued urban expansion of Melbourne up to its Urban Growth Boundary would result in a further 900 kilometres of waterways being degraded by urban runoff if current

stormwater drainage practices continue.[1] In the absence of comprehensive, science-based initiatives, further deterioration of Melbourne's waterways is all too likely.

Fortunately, research has provided insights into how we can better protect the condition of our urban streams. A key finding is that the altered flow regime associated with catchment urbanisation is a significant factor in the degradation of stream ecosystems. Directly discharging stormwater flows from even small areas of an urban catchment (as little as 5%) can severely degrade stream ecology.[2,8,9]

These findings led to the release of Victorian guidance in 2021, which sets out a two-tier flow reduction regime. This guidance applies stringent flow targets (that require stormwater flows from urban development to be greatly reduced by a combination of stormwater capture and infiltration, resulting in a more natural hydrologic regime) in catchments that drain to undisturbed high ecological value waterways, while less stringent flow controls apply in catchments draining to degraded waterways.[10] The logic here is that stringent flow controls are justified to protect the valuable ecosystems in (relatively) intact waterways, whereas less rigorous controls prevent further deterioration of heavily degraded streams, which contain impoverished ecosystems. These flow controls apply in addition to the urban stormwater quality targets (i.e., the mandatory reductions in suspended solids, phosphorus, and nitrogen loads).

While the introduction of controls on urban stormwater quality and flow are important steps, we have to recognise that they are not cure-alls. Factors such as the reduction of vegetation in catchments, particularly that growing immediately adjacent to streams ('riparian' vegetation) and drastic physical modifications also harm the ecological health of urban streams.2 These damaging changes constrain the improvements to ecological and social conditions that stormwater quality and flow controls can achieve in the dramatically modified waterways commonly found in Melbourne. If we want to maximise the benefits provided by urban waterways, a broader approach is required.

Restored Ephemeral Watercourse in Napier Park, Strathmore, Fed by Stormwater Previously Piped Underground (Image: Don Williams)students in 2013.

This will require a paradigm change, where our ambitions expand from protecting urban waterways from degradation, to recovering lost values by 'naturalising' degraded urban streams. This would involve, for example, restoring the beds and banks of waterways to more natural conditions and restoring as much vegetation as possible in their catchments, particularly riparian vegetation. Fortunately, several projects of this type are being planned or have recently commenced in Melbourne.11 These projects must be guided by good science, which identifies the feasible ecological outcomes that can be achieved by an urban stream restoration project, integrates ecological and societal perspectives, and emphasises a multidisciplinary approach. As complete restoration of pre-European ecological values is unrealistic, a vital role of science is to identify the ecological improvements that are feasible. These findings will inform decision making about balancing ecological and social outcomes.[12]

We can expect that projects to rehabilitate urban waterways will face the typical trade off in natural resource management, where achieving increasingly 'natural' conditions requires a stronger set of interventions and greater costs. Good science can provide decision makers with information about these trade-offs.

CONCLUSIONS

The condition of Melbourne waterways declined severely after European settlement, as a result of massive modifications to catchments and the waterways themselves. The general decline of waterway condition includes deteriorated ecological values. Fortunately, science has identified the mechanisms responsible for these changes and also suggests how we could restore some of the waterway values we have lost.

Projects to restore urban streams will need to integrate science and insights from the community.[13] Best results will be obtained by engaging a whole range of groups, including community groups, schools, the tertiary sector, citizen scientists and, importantly, learned societies such as the Royal Society of Victoria.

Dr. Don Williams MRSV worked for 30 years in the water quality management, wastewater regulation and water efficiency fields. Don then completed a PhD examining how planning laws influence the adoption of sustainable urban water practices. After the PhD, Don worked at Environment Protection Authority Victoria on regulating urban stormwater runoff.

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THE FUTURE OF MENTAL HEALTHCARE: LESSONS FROM BARWON

By Dr Catriona Nguyen-Robertson MRSV

This article revisits the online panel discussion, "Transforming Mental Health – The Barwon Region Experience", hosted by the Convergence Science Network (CSN) on 23 November 2020. Panellists included community advocates, people with lived experience of mental illness, clinicians, and researchers.

'Mental health is increasingly being recognised as one of the most important and yet challenging issues of our time,' says Renae Carolin, Interim Director of CHIME (Change to Improve Mental Health Centre of Excellence).

Most people living in Victoria will be affected by mental illness at some point in their lives – either directly or indirectly. Yet, despite the 2019 Royal Commission into Victoria's Mental Health System and billions of dollars of investment over the past few years, the sector remains in dire straits. Mental health services fail to provide sufficient treatment, care, and support to people living with mental illness, their families and careers.

"There is a profound human toll that accompanies a broken system," according to the Royal Commission into Victoria's Mental Health System.[1]

But things are changing.

CHIME is a recently established partnership between Barwon Health and Deakin University that aims to lead reforms in the mental health care system. It brings different voices together: those with experiences of mental illness and support services, clinicians and researchers with extensive experience in mental health, and those at the forefront of mental health care reforms at both the State and Federal levels. CHIME is transforming how people undertake and translate research into the provision of mental health services in the Barwon region - and we should be adopting their methods throughout the state.

LEARNING FROM LIVED EXPERIENCE

The increased role of people with experience of mental illness is a game changer in mental health care reform. People who experience mental ill-health and the journey of recovery have unique insights and knowledge to bring to the sector. Following the Royal Commission into Victoria's Mental Health system, we are starting to see a culture shift: recognition of those with lived experience as strategic partners, not merely stakeholders.

Personal reflection goes a long way. Workers across the entire sector need to ask themselves whether the care or support they are providing and the system they are working in is what they would expect or hope for themselves or the people they care about.

Dr James McLure, a Senior Peer Support Worker at Barwon Health, experienced schizophrenia and mental health deterioration for seven and half years. Once he sought help, he started his journey of personal growth, which was harder than anything he had done before. Knowing first-hand what this journey is like, he now guides others as a Peer Support Worker.

Peer Support Workers, like him, have personal, unique experiences of mental illness and recovery, and share collective wisdom. 'It's so great to speak to someone who gets it,' James says. 'We learn from each other, heal each other, and are a blessing for each other.'

CHIME is a collaboration between Barwon Health and Deakin University, based at the University Hospital Geelong.

Those who have loved ones experiencing mental illness also have a unique perspective to drive service improvements and better outcomes. Marta King is a champion advocate for carers supporting those experiencing impaired mental health. She became a carer first for her mother, and now is a Carer Peer Support Worker at Barwon Health. When her mother's mental health declined, Marta took her to support groups and – similar to James' experience – she saw that listening to others with similar experiences gave her mother strength. Becoming a carer is a journey in its own right, and Marta acknowledges that carers may feel out of their depth or anxious at times. She believes that carers need to be more involved in the discussion around reforms so that they receive the support they themselves need. 'Carers are involved because – well – they care,' she says. 'They need to feel connected to their loved ones.'

Tony McManus, National Ambassador for Beyond Blue and Community Ambassador for RU OK?, also became a passionate advocate for mental wellbeing because of a loved one. His life turned upside down when he lost his younger brother to suicide. At the same time, he was dealing with his own depression and anxiety. Tony focuses on the importance of social connection as a mental health solution. He turned his own personal experience of depression into making a positive difference to the lives of others, and now encourages those suffering from mental health issues to mentor or volunteer themselves. 'The best exercise that you can do is to help someone else who is down to get up…you get that warm, fuzzy feeling' he says. He believes that social connection can help overcome the isolation, and that it builds connections and resilience in communities.

A COLLABORATIVE, CONVERGENT EFFORT

CHIME aims to deliver an approach to mental health service improvement that is co-designed by researchers, clinicians, consumers, carers, policymakers and the community. A consumer-oriented approach is going to have the best outcomes for consumers – they need to be guiding mental healthcare reforms as they know what key services and resources they need most.

'The most important policy reforms are those that make practical and measurable differences in the lives of people,' says Mr Alan Woodward, a Commissioner for the National Mental Health Commission. 'We need to support the mental health and wellbeing of the Australian population so that no one is left out.'

To harness the collective wisdom of academics, clinicians, those with lived experience, and the community going forward, CHIME has implemented a process of continual learning and incremental change. Mental health issues cannot be solved by one person or one discipline, but rather, require a combination of expertise in different areas for the best outcomes. When it comes to changing the system, especially taking on board recommendations from the Royal Commission, we are not going to see change in one, transformative step. The system will need to engage in a process of continual improvement as a collaborative effort.

FIXING A BROKEN SYSTEM

Many Victorians want to see change in the "broken" mental health system. Low expectations have been tolerated for decades. It is only now that healthcare providers are being challenged to consider what "good" looks like. However, Dr Ruth Vine, Australia's first Deputy Chief Medical Officer for Mental Health, having come into the role, acknowledges that the system architecture does not make it easy to understand what people want or to create change.

Change is difficult when investment and leadership in the system is poor. Victoria's monetary investment in mental health is low compared with the rest of Australia, and grossly disproportionate compared with funding for physical health. Without a federal level discussion of what is needed and who is responsible in terms of leadership and funding, it will be difficult to implement change. 'There is no clear way in or pathway through,' Ruth says.

A large concern is the "missing middle". Victorian mental health services were not designed to deal with the increasing demand for support. Nor are they equipped to cover the range of care required by people experiencing mental illness and psychological distress. A large and growing group of people have mental illnesses that are too complex, too severe and/or too enduring to be treated through primary care alone, but do not qualify for specialist mental health services. Their care needs are either insufficiently met or not met at all.

As a community, we are trying to reduce stigma and encourage people to reach out when they need help. However, if the services are simply not there or are inaccessible, telling people to ask for help may not be so helpful. Even as recently as last year, people at low points in their lives who went to hospital emergency departments had to wait up to 12 hours to be seen, and headspace centre wait times were over 10 days on average.[2, 3] There is clearly an urgent need to address the wait times and unmet need of people seeking to access mental health services in Victoria.

We need new investment into centres that specifically cater to this massive missing middle. This will allow for increased clinical workforce capacity and larger facilities to meet the growing needs of Victorians. We also need to augment existing platforms and services to better care for people with more severe and complex conditions, which is becoming increasingly possible with developments in medical monitoring technology and digital healthcare.

Issues in the system are typically patched up individually. There are many, duplicated, scattered points for access to care and support services. While the right intentions are there, separately implemented solutions lead to a fragmented system, causing further confusion for both consumers and providers. Greater coherency in the system would make it easier to navigate.

We have an opportunity to transform mental health care in Victoria. Mental illness is without question, one of the greatest challenges we face. It is largely invisible and silent, yet devastating for individuals, families, friends and communities. Collaboration and open discussions such as these will be needed to transform mental health services in the Barwon region and across Victoria.

*The Convergence Science Network (**convergencescience-network.org.au**) hosts a range of presentations that promote advances in the biomedical sciences to the community. The recording of Transforming Mental Health – The Barwon Region Experience panel discussion can be watched at: **youtube.com/watch?v=DK6MOEnMR48***

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NATALIA TRAYANOVA: QUEEN OF (DIGITAL) HEARTS AND INNOVATIVE CARDIOLOGY

By Catriona Nguyen-Robertson MRSV

This article follows the 2022 Graeme Clark Oration, presented by Professor Natalia Trayanova (Johns Hopkins University) on 12 July 2022, hosted by the Convergence Science Network (CSN).

When it comes to your heartbeat, you want it the way Goldilocks does: just right. Improper beating of the heart – whether too slow or too fast or irregular – is known as arrhythmia. Professor Natalia Trayanova is revolutionising the way we track and treat our hearts. Natalia is a Professor of Biomedical Engineering and Medicine at John Hopkins University. Her team has developed an artificial intelligence (AI) algorithm to predict if – and when – someone will have a heart attack within ten years. They have also created a "digital twin" model of patients' hearts for cardiac surgeons to simulate treatment options to determine the best one. She never imagined that she, an engineer with no formal medical training, would be in an operating theatre with surgeons looking to her for the "ok" before performing a procedure. However, with medicine evolving to become more interdisciplinary, it is teams such as Natalia's that are at the cutting-edge.

Prof Natalia Trayanova, presenter of the 2022 Graeme Clark Oration. The Graeme Clark Oration celebrates advances in health and medical research that impacts people around the world, in honour of the pioneering effort of Prof Graeme Clark's development of the cochlear implant.

Source: Graeme Clark Oration and the Convergence Science Network

PREDICTING A HEART ATTACK

Many people experience an arrhythmia at some point in their lives. And, although they are usually harmless, arrhythmias can be life-threatening. In some cases, they lead to sudden cardiac death (SCDA) – the heart suddenly stops beating. SCDA, which is specifically caused by arrhythmia, is one of the biggest killers of Australians under 50.[1]

Arrhythmia occurs when electrical impulses in the heart do not work properly. Implantable cardioverter-defibrillators can be placed in the chests to detect and correct irregular heartbeats in high-risk people. These defibrillators continuously monitor the heartbeat and deliver an electric shock to restore a regular heart rhythm when needed, as the electricity resets the heart's own electric pulse. However, this device is mainly for a certain type of arrhythmia and helps fewer than 20% of people who suffer SCDA.[2]

Highlighting the importance of a shift towards personalised medicine, research into monitoring SCDA risk has mainly taken a one-size-fits-all approach that clearly does not help everyone. There are patients who may be at low risk of SCDA receiving defibrillators that they might not need, and there are high-risk patients that are not getting the treatment they need and could die in the prime of their life.

Natalia's solution, can instead be personalised for all patients, and if implemented widely, may prevent as many as 20% of all deaths worldwide.[3] The technology, called Survival Study of Cardiac Arrhythmia Risk, (SSCAR) uses AI neural networks to build a personalised survival assessment for each patient with heart disease that can then inform their treatment plan.

The name, SSCAR, is a nod to the cardiac scarring caused by heart disease that often results in life-threatening arrhythmias, especially in patients who have already had one heart attack.

During a heart attack, oxygen deprivation causes part of the heart to be damaged, forming scar tissue. Heart attack victims are therefore particularly prone to irregular rhythms. Scarring can cause the electrical wave before a heartbeat to become disrupted, bouncing back or reverberating rather than acting as a single wave. The heart stops contracting in a synchronous manner and, in Natalia's words, becomes more like a 'bag of wiggling worms'. This scarring is key to the predictions; the neural networks learn from a patient's heart scans, especially taking note of the scar distribution.

As machine learning algorithms learn best with many examples, the team used hundreds of cardiac scans from patients at John Hopkins Hospital. These images all showed scarring around the heart so that the algorithm could be trained to detect patterns – something clinicians cannot do. When clinicians look at these types of images, they note simple scar features, but there is much more information not visible to the naked eye. The scars can be spread through the heart in different ways, and each pattern says something about a patient's chance of survival.

SSCAR's predictions so far appear better than the standard measures and prediction methods currently used by doctors.[4] Further, its accuracy has been validated in tests across 60 US health centres. Given that patients in other health centres had different cardiac histories and different imaging data to what the algorithm was originally trained on, this suggests that the technology is highly adaptable.

This is the first time that neural networks have been used to build a personalised survival assessment for patients with heart disease. SSCAR can determine who is at risk of heart attacks due to arrhythmia and when they will occur.

But what can be done if you know that sudden cardiac death is coming? Natalia has figured that out too.

TREATMENT OPTIMISATION WITH A DIGITAL HEART TWIN

By creating a digital twin of a person's heart based on their scans, the virtual version of the heart can be extensively probed and prodded. Doctors can use this new computer-based method to simulate different treatment options and thus inform a patient's treatment plan.

Arrhythmia can be treated with ablation: burning a particular spot in the heart. Surgeons assess a patient's heart to find a good spot for ablation, however, there may be multiple places where the electrical rhythm appears to be off. If the root driver of the arrhythmia is not terminated and merely an off-target spot is burned, the arrhythmia will simply return over time. In many cases, the arrhythmia does indeed come back, the patient returns to hospital, and they do it all over again – all the while, the patient is accumulating more heart damage.

With a personalised digital heart twin based on a patient's scans and medical history, Natalia's team can find the perfect spot for ablation the first time round. They simulate the ablation in potential places of the digital replica, playing out each scenario virtually to find the best place for ablation prior to burning a patient's real heart.

None of the members on Natalia's team are medical professionals – they are all engineers. Yet in the operating theatre, the surgeons look to her and her team before beginning the treatment. Natalia finds it exhilarating, and somewhat surreal, that her team is giving such an amazing sense of responsibility in a medical procedure, but it means that patients do not need to come back.

COLLABORATION IS KEY

The technologies developed by Natalia and her team are empowering cardiologists to decide what needs to be done for each patient and when to prevent cardiac death. The team also hopes to build similar algorithms to monitor other heart diseases, and the technology could even be extended into other fields of medicine that also rely on clinical imaging and visual diagnosis.

Natalia's work exemplifies the use of convergent science: technology, engineering, physics, and medicine in collaboration as the future of cardiology and healthcare in general. Computational approaches and AI as major tools in healthcare and precision medicine, and we will hopefully see the latest research translated into practice and clinicians adopting these cutting-edge tools soon.

*Professor Natalia Trayanova delivered the 2022 Graeme Clark Oration in Melbourne. Hosted by the Convergence Science Network (**convergencesciencenetwork.org.au**), her presentation outlines the new technologies in greater depth, and can be watched at **youtu.be/Bnxgi6cglwQ***

*The Graeme Clark Oration, named after the inaugural Oration delivered by Professor Graeme Clark (inventor of the multi-channel cochlear implant), celebrates world leaders and advances in medical research and developments in convergence science. All past presentations are available to watch online at **www.graemeclarkoration.org.au/past-orations.html***

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THE GOALS OF THE GOALS: THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

By Scott Reddiex MRSV

Most of us share in the general feeling of wanting everything to be the best it can be: healthy people, healthy ecosystems, on a healthy planet. Yet with all of the complex problems that the lives on Earth currently face, it can seem insurmountable. Where do we start? What then are the most important and most urgent problems to tackle? How do we, as a group of 7.97 billion people, solve the biggest issues?

One answer to the questions of 'what' and 'how' are the United Nations Sustainable Development Goals (UN-SDGs).

The UN-SDGs are 17 goals for improving human lives and protecting the environment, which identify the specific areas to address, provide achievable targets, and set the deadline of 2030.[1]

These goals haven't appeared out of nowhere. Instead, they build on decades of work by the UN and member countries, and were adopted by world leaders at the UN Sustainable Development Summit in 2015.[1] Each goal is further broken down with individual targets that are required to achieve the overall SDG.

1. No Poverty:
End poverty in all its forms everywhere.

2. Zero Hunger:
End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

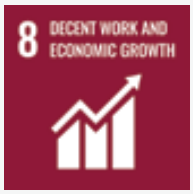
3. Good Health and Well-Being:
Ensure healthy lives and promote well-being for all at all ages.

4. Quality Education:
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

5. Gender Equality:
Achieve gender equality and empower all women and girls.

6. Clean Water and Sanitation:
Ensure availability and sustainable management of water and sanitation for all.

7. Affordable and Clean Energy:
Ensure access to affordable, reliable, sustainable, and modern energy for all.



8. Decent Work and Economic Growth:
Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.

9. Industry, Innovation, and Infrastructure:
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

10. Reduced Inequalities:
Reduce inequality within and among countries.

11. Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable.

12. Responsible Consumption and Production: Ensure sustainable consumption and production patterns.

13. Climate Action: Take urgent action to combat climate change and its impacts

14. Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development

15. Life on Land: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

16. Peace, Justice, and Strong Institutions: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels

17. Partnerships for the Goals: Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

THE ROLE OF STEMM

The development of the SDGs and the work to reach these goals is dependent on the STEMM fields. Science has been a critical component of gathering data and highlighting the interconnectedness of social, economic, and environmental issues, and research in STEMM is crucial in identifying the most effective strategies for achieving the targets of each SDG. There is a critical role here for science communications, which translates complex scientific information into accessible language, engaging visuals, and compelling stories that can reach diverse audiences, including policymakers, the media, and the general public.

It's one thing to have developed a solution, but that solution is meaningless if it can't be explained to the people required for its translation.

How can we utilise the SDGs as individuals and organisations? While these goals have broken down the overwhelming mass of problems to urgently address into slightly less-whelming pieces, they are still quite a task for any single group or individual to overcome. This leads us to the question of: how can we use the SDGs?

At the highest level, the goals set the shared goalposts, and make it easier for groups to signal and identify potential alignment in values and strategy. While it's not an immediate guarantee of success, it serves as a useful level of filtering that says, "we might be on the same page about this". For groups of people - companies, governments, community groups, organisations, etc. - the SDGs can be utilised in setting the local targets and developing informed strategies. This forms more of the 'who are we, and what do we stand for?', which can then be followed by advertising those values and finding the like-minded.

At an individual level, familiarity with the SDGs can make it easier to identify the major issues facing the planet, and to keep involved in addressing particular topics that a person might care about. Individual action could take the form of working with a community group, writing a letter to a member of parliament, addressing gender equality in the workplace, or choosing to shop with companies who are making meaningful steps to support one or more SDGs.

WHERE ARE WE AT?

With the UN-SDGs having come into force on 1 January 2016, we are now half-way towards the 2030 deadline. While good progress is being made against particular targets, an advance version of the 2023 SDG progress report indicates that 'the world is not on track to meet most of the Goals by 2030.'[2]

Our response to this should never be simply to give up. To label it impossible, or lower the bar. These are big problems, but as a collection of almost 8 billion people, we currently have the ability to fix all of these problems. At the scale of individuals, communities, not-for-profits, and small businesses, there are financial pressures that have come in the wake of a pandemic and natural disasters. At the exact same time as many people around Australia are skipping meals to make their money last until next payday, companies like Santos[3], the Commonwealth Bank[4], BHP[5], Qantas[6], Woolworths[7], Coles[7], are posting profits (some of them record highs) in the hundreds of millions or billions of dollars.

The scientists and engineers are there. The urgent need is there. The motivation is there. The money is there. Now we need policies to follow.

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FUTURE HEALTHCARE SOLUTIONS EXPLORED AT MONASH TECH SCHOOL

by Dr Catriona Nguyen-Robertson MRSV, with Rebecca Taylor, Program and Project Facilitator at Monash Tech School.

Making health super fun, super creative, and super innovative, secondary school students have been thinking about how they could transform healthcare as part of programs run by Monash Tech School. They have taken on the role of scientists, and combined scientific disciplines to design and prototype cutting-edge solutions that tackle challenges experienced by workers and patients in Victoria's healthcare system.

SUPERHUMANS

In the Superhumans program, run from 2017-2020, Year 7 students worked in teams to design implants, smart clothing, wearables, and bionic devices for people with various impediments or diseases. The popularity of Fitbit and other wearable fitness devices is driving the innovation of wearable medical technologies for a variety of clinical uses. Advances in soft, flexible, and stretchable sensors have offered a good opportunity to design various types of wearable flexible medical devices for continuous health monitoring and preventive medicine, such as non-invasive blood glucose sensors. Furthermore, developments in wireless technology, smaller devices, and computing power are changing the landscape of the interconnectedness of devices for bionic eyes and heart monitors. A rapidly ageing population, the shift toward delivering in-home healthcare, and the increasing prevalence of diabetes, hypertension, and other chronic diseases are expected to boost a need for medical devices in the next decade. As part of the program, student teams investigated a medical condition and used case studies and props to put themselves in the shoes of those living with it to better understand patient needs. Students were challenged to brainstorm ideas for medical implants and devices, such as bionics, that consider how technologies will interface with humans and impact our lives for the better.

Similar to research teams in the medical technology (MedTech) industry, Monash Tech School emphasises the importance of people with different skill sets coming together to work on a project. No one person is an expert in everything, and research groups are becoming increasingly multi-disciplinary. Within their teams, students were allocated roles and investigated the problem from different angles (e.g., investigating the electronics element or the intricacies of human anatomy). With electronics, microscopes, 3-D printers, laser cutters, and a materials library at their disposal, the sky's the limit.

By the end of the program, student teams had built a model prototype and pitched it to an audience of their peers. One group of students from Wellington Secondary College designed and pitched a device to replace a faulty heart valve. The team created a prototype with Lego and then a 3-D printed model of their valve replacement that could fit inside a heart. Another group of students created an eye pump system for glaucoma patients. Vision loss experienced with glaucoma is usually caused by a clogging of the eye's drainage system such that fluid builds up in the eye and presses on sensitive nerve fibres. Students pitched a bionic drainage pump device to drain fluid, thereby alleviating pressure on nerves in the eye to restore vision.

A "Bento Lab". These devices function as a portable molecular biology lab, combining a PCR machine, microcentrifuge, gel electrophoresis, and a transilluminator to amplify and visualise DNA

CYBORG PSYCHOLOGISTS

As technologies advance, engineered enhancements, such as those designed by students, will become increasingly accessible. People already use prosthetic limbs, heart valves, bionic ears and eyes, and there will be many more devices and aids on the market in the near future. People who incorporate these technologies into their lives will require support to accept their new life as a "cyborg". Ford Australia, Deakin University, and Griffith University predicted this need in their 100 Jobs of the Future report[1], listing "cyborg psychologist" as a role that will emerge in the coming years. A future cyborg psychologist would work with people with synthetic organs, robotic limbs and body implants, to help them ease into the transition of living as cyborgs. As part of its current Superskills series, Monash Tech School developed an online program, Cyborg Psychologist, to encourage students to imagine a career becoming or training future Cyborg Psychologists.

SUPERHEALTH

In the Superhealth program (2018-2020), Year 9 students took a more overarching approach to healthcare. Their challenge was to create visions of future hospitals, learning from the experiences of professionals currently working in the healthcare sector to inform their hospital designs. Part of the program involved thinking about the best way to diagnose diseases and find the most effective treatments. Students looked at microscopy slides of patient samples and identified signs of disease pathology – but they soon realised that this alone is not enough to decide on a treatment. Students were introduced to the idea of personalised healthcare based on the genetics of disease. They analysed mock patient DNA samples using Bento Lab boxes – devices that function as a portable molecular biology lab, combining five pieces of scientific equipment into one. By sequencing DNA samples and looking for specific genetic markers, they could determine what type of cancer a patient had, which bacterium a patient is infected with, and answer other questions.

Jumping into the industry side of healthcare, students also learnt about the synthesis of therapeutic proteins (e.g. insulin, hormones, therapeutic antibodies, etc.). To make large batches of therapeutic proteins, the biotechnology industry makes use of bacteria and yeast that reproduce in large numbers without the need to ever rest. Scientists genetically modify bacteria or yeast by inserting a gene encoding a given protein, turning them into little factories to pump out a limitless amount of protein. The bacterium E.coli, for example, reproduces every 20 minutes, and can therefore be manipulated to produce an exponentially increasing amount of a protein once provided with the genetic instructions. Students tried their hands at genetic engineering themselves, introducing the "green fluorescent protein" gene into E.coli, making the bacteria glow green under ultraviolet light when successful.

Students get hands-on with equipment, encouraging tactile learning and sparking an interest in STEM among some students who had not previously considered it. The genetic engineering and biotechnology experiments performed by students in Monash Tech School programs are typically not covered until their second or third year of an undergraduate university degree. But under the guidance of Monash Tech School staff, they successfully complete all tasks. 'This proves that biotechnology is not beyond secondary students,' says Andrew Gray, a former Monash Tech School Lab Facilitator.

After the completion of a core or online program, students are encouraged to continue their exploration of health industries by participating in a hands-on industry-focused event. Monash Tech School has partnered with Holmesglen's Faculty of Health Science, Youth and Community Services Simulation Centre to co-design and deliver Industry Immersion Days, which focus on careers in Healthcare sectors, especially given the students' proximity to Monash Medical Centre, Monash Children Hospital and the new Victorian Heart Hospital. In these Industry Immersions, students rotate through hands-on sessions that allow them to use technology in a simulated environment, meet medical professionals, and learn about the occupations in demand and the pathways options available. Students also earn digital microcredentials as they complete tasks that align with key skills - a modern approach to collecting physical certificates of participation. Healthcare occupations are in strong demand, and Industry Immersions are an opportunity to engage students in investigations that allow them to make informed decisions about which pathways they may pursue in the future.

Monash Tech School programs build and elevate technology and innovation skills in the next generation of students going into the STEM workforce. They also foster communication, teamwork and project management acumen by challenging students to collaborate in interdisciplinary teams to ideate, prototype and pitch a solution. As a team, students are given the responsibility to learn the different technologies and apply their knowledge and technology to explore and create their own solutions or create a vision of how technology could be used to augment healthcare. Students are encouraged to dream big in their design-thinking process, and some of their ideas may evolve to take their place in the MedTech industry in years to come.

References:
1. 1. Tytler, R., et al. (July 2019). 100 Jobs of the future. Ford Australia. https://100jobsofthefuture.com/report/jobs/

Students use coffee filters and fake blood to simulate the function of the kidneys.


Monash
Children's
Hospital

Mountain Ducks, also known as Australian Shelducks, are one of Australia's native duck species.

1973

DUCK, DUCK, DUCK... DUCK

By Scott Reddiex MRSV

First published in 1855,[1] one of the particularly valuable aspects of the *Proceedings of the Royal Society of Victoria* is that it serves as a record of Victoria's ecology over the past 168 years. This allows for comparison of plant and animal populations (and contemporary thoughts on them) at different points in time – something that serves as a useful tool in the face of the current biodiversity crisis.

In the 1974 edition of the *Proceedings*, Frederick 'Ian' Norman from the (relatively new) Arthur Rylah Institute for Environmental Research published a piece on the 'Movement and Mortality of Black Ducks and Mountain Ducks Banded in Victoria'.

The purpose of the piece was to summarise data relating to these two species of native duck that had been obtained from 'banding operations' conducted by the Victorian Fisheries and Wildlife Department between 1952 and 1969. These were capture-mark-recapture studies, with captures taking place at 29 locations across Victoria, and the 'banding' referring to the identification bands applied to the legs of the ducks.

Pacific Black Ducks *(Anas superciliosa superciliosa Gmelin)* are found around Australia, New Zealand, Papua New Guinea, Indonesia, and other islands of the southwestern Pacific. Mountain Ducks *(Tadorna tadornoides Jardine and T. tadornoides Selby)*, also known as Australian shelducks, are found mainly in south-eastern and south-western Australia, and have been a protected species in New South Wales since 1974. While the Black Ducks are more abundant, their numbers have sharply declined over the past century due to overhunting and competition from introduced species.

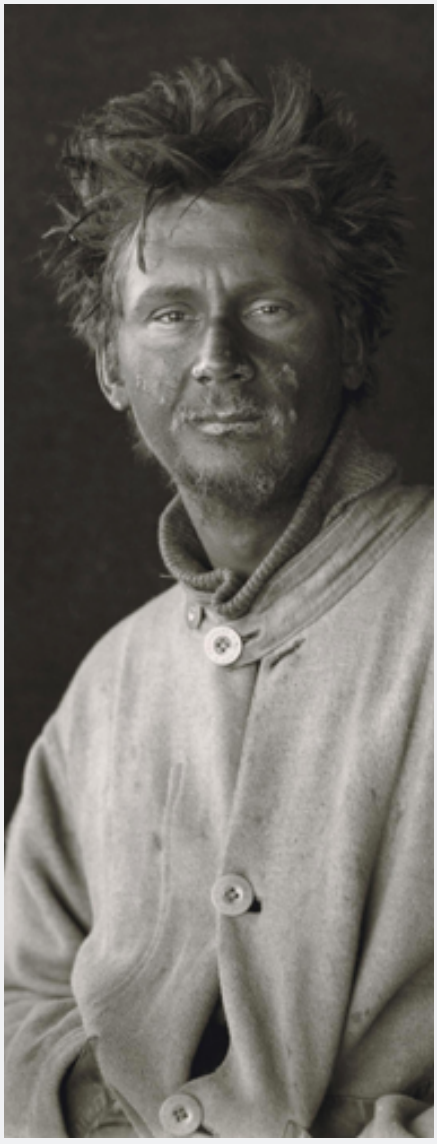
In this 17-year period, 9,442 ducks (5,644 Black Ducks and 3,798 Mountain Ducks) were banded and released in Victoria. Of those marked and released, the bands from 2,210 deceased ducks were subsequently recovered (1,461 Black Ducks and 749 Mountain Ducks). The cause of death for more than 80% of the recovered ducks was shooting, with most birds shot within a year of banding. This leads to the macabre calculation that each Black Duck pair must raise four young, and Mountain Ducks two young, to the flying stage each year to sustain the present shooting pressure.

Both the Pacific Black Duck and the Mountain Duck/Australian Shelduck remain on the list of native ducks that can be hunted legally in Victoria, despite their numbers being now a fraction of what they once were. The combined impacts of hunting, drought, destruction of wetland habitats, competition from and interbreeding with the introduced mallard, pet dogs off-leash in wetlands, and feral animals, have all taken a large toll on these and other native waterfowl.[2,3,4]

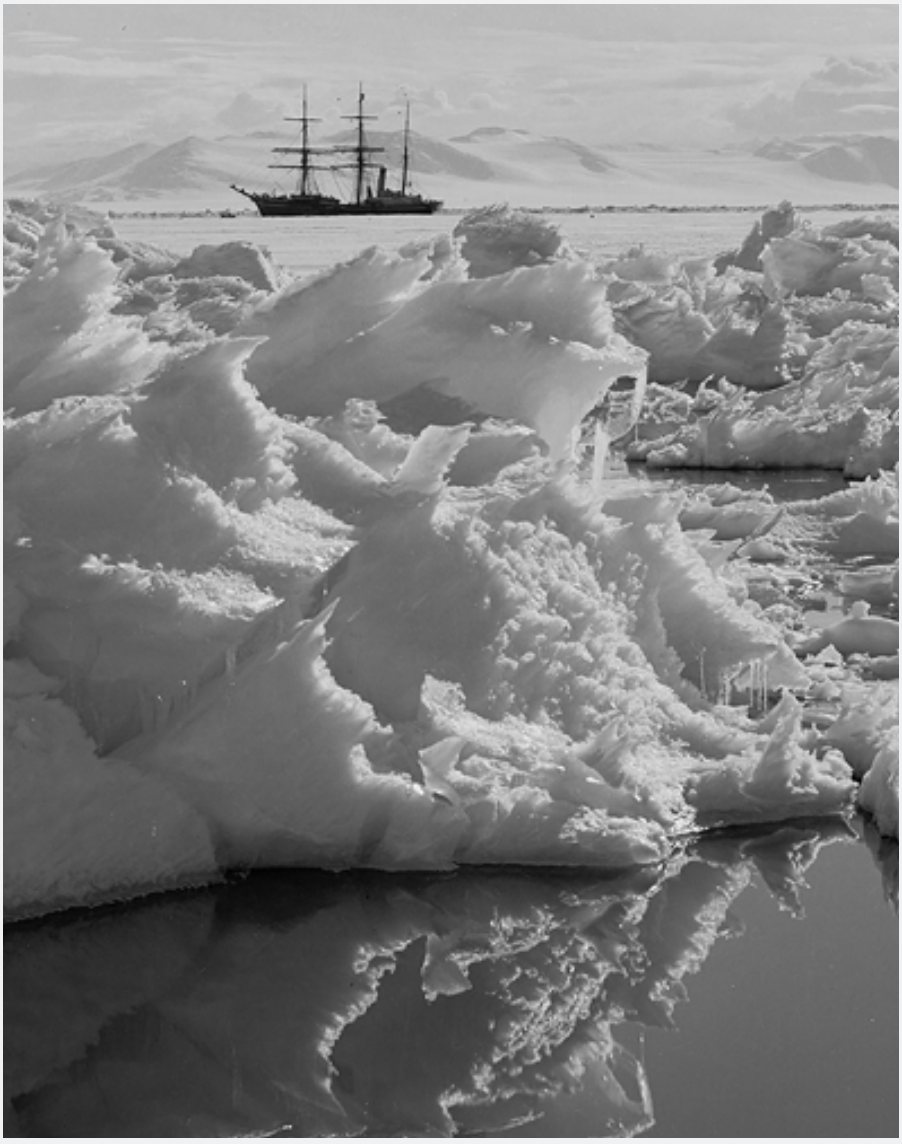
From:
Proceedings of the Royal Society of Victoria, Vol 86 (New Series), 1974. Movement and Mortality Patterns of Black Ducks and Mountain Ducks Banded in Victoria. By F. I. Norman.

References:

1. First published in 1855 as the *Transactions of the Philosophical Society of Victoria*.
1. 2. Ramsey, D., & Fanson, B. (2021). Abundance Estimates for Game Ducks in Victoria Results from the 2020 Aerial Survey. gma.vic.gov.au/__data/assets/pdf_file/0008/829574/Abundance-Estimates-for.pdf
1. 3. The State of Australia's Birds 2004 – Water, Wetlands and Birds dcceew.gov.au/sites/default/files/documents/birds-04.pdf
1. Porter, J., Kingsford, R., Francis, R., Brandis, K., & Ahern, A. (2022).
1. 4. Eastern Australian Waterbird Aerial Survey - October 2022 Annual Summary Report. unsw.edu.au/content/dam/pdfs/unsw-adobe-websites/science/bees/ces/Eastern-Australia-waterbird-aerial-survey-2022-Final.pdf



Sir Charles Seymour Wright, KCB, OBE, MC. Photographed in 1912 by the British Antarctic Expedition's photographer and cinematographer, Herbert Ponting. (Public Domain)



"Beautiful broken ice, reflections and Terra Nova. Jan. 7th 1911." Terra Nova, the ship used to take Robert Falcon Scott's expedition to Antarctica. Photograph by Herbert Ponting (Public Domain)

1923

A BRIEF UPDATE ON A WEAK FORCE

By Scott Reddiex MRSV

One of the beauties of the scientific method is that, when confronted with new data, it can review and update results and conclusions as required. This was the case in 1923, when physicist Dr. Ernest F. J. Love penned a supplementary note to his previously published piece, *Acceleration of Gravity at the Melbourne Observatory.*

He begins with the reason for his update: "*The present note is a necessary supplement to my paper of last year on Gravity Determinations in Australia, as the subsequent appearance of Wright's memoir has reopened the question as to the most probable value of g [the gravitational constant] for Melbourne.*"

In this scenario, the new data comes in the form of 'Wright's memoir': 'Wright' being Sir Charles Seymour Wright, and the 'memoir' referring to the 1921 publication of 'Determinations of Gravity' from the British (*Terra Nova*) Antarctic Expedition of 1910-1913.

Sir C. S. Wright had joined Captain Robert Falcon Scott's ill-fated journey to reach the geographic South Pole, working as a glaciologist and assistant physicist. As part of his role, he had assisted with measurements of the acceleration of gravity in Antarctica, as well as performing other experiments. On the journey to Antarctica, Wright had made measurements of the gravitational constant in Melbourne, which Dr Love described as a 'considerable variation' from the previously published value.

The reasons for this variation, he deduced, were more likely to be due to instrumental uncertainties, rather than actual variations in gravity as Wright was suggesting. After consideration of six different observations, including that of Wright, Dr Love was able to produce a final calculation of *g* for Melbourne of 9.79993 m/sec2.

Wright was fortunate to have been able to publish the findings of the British Antarctic Expedition – in December of 1911, 480 km from the geographic South Pole, he had been part of a group that was sent back by Scott. After returning to Cape Evans on the coast of the continent, he waited to no avail for the return of Scott's group. Eventually joining the search party in late 1912, he located the tent on the Ross Ice Shelf that contained the bodies of Scott and his two companions, who had died in March 1912 on their return from the pole.

From:
Proceedings of the Royal Society of Victoria, Vol XXXVI (New Series), 1924. Article II - Acceleration of Gravity at the Melbourne Observatory: Supplementary Note. By E. F. J. Love, M.A., D.Sc., F.E.A.S

Dr James Edward Neild, c. 1868. Photograph by Johnstone, O'Shannessy & Co., Melbourne. (Public Domain)

1873

BRING OUT YOUR DEAD

By Scott Reddiex MRSV

An important question that has faced all human societies is what to do with the deceased. On Monday the 8th of December 1873, the RSV heard one answer to this question, in the form of a piece by Dr James Edward Neild M.D. titled, "*Advantages of Burning the Dead*".

Dr Neild provided his professional opinion, as a medical doctor and lecturer in forensic medicine at the University of Melbourne, and having spent the preceding seven years '*examining some hundreds of bodies in all stages of decomposition*':

"*I think there is no more loathsome object than a putrid human body. It offends the senses, and it shocks the sensibilities, even of those whose duties make them familiar with the sight. As a rule, interment takes place before decomposition has advanced sufficiently far to alter the appearance of the dead, so that sorrowing survivors are not generally distressed by witnessing those repulsive changes, which begin to take place more or less rapidly, according to temperature, as soon as life ceases.*

But they do take place, whether the body be above ground, in the earth, or under the water. A number of offensive gases are liberated, and the air is thereby contaminated, and rendered to that extent less fit for respiration. Doubtless it is only in the course of nature, that the human body, like every other organised substance, should undergo those changes by which the elements composing them separate from each other, in order to effect new combinations, and serve in their turn to compose other organised structures."

"*I have for some time concluded that it would only be in accordance with the progress of hygienic improvement, to substitute for the slow, dangerous, and loathsome process of putrefactive fermentation, that of rapid decomposition by fire.*"

After spending many pages describing what he viewed as the offences of a corpse and strongly advocating for their combustion, he describes some of the funeral rites of different countries and cultures, and the long history of cremation. Having made his case, he then explains how it would best operate in the modern age:

"*As to the particular mode by which the process of cremation is to be accomplished, I need hardly speak in detail. Science is now so fertile in resources, that no practical difficulty will be found in this respect. The slow and clumsy method of surrounding a body with logs of wood, and then igniting the pile, may be picturesque and classical enough, but it would not be in accordance with modern improvements.*

I believe, by a properly-constructed Bunsen's gas-burner, an average body could be reduced to powder in about a quarter of an hour."

James Edward Neild (1824–1906) was an incredibly accomplished man. In addition to practising medicine, he was a forensic pathologist, writer, theatre critic, lectured at the University of Melbourne for decades, co-founded the Victorian branch of the British Medical Association, co-founded the St John Ambulance Association in Australia, and was the first president of the Victorian Eye and Ear Hospital. Neild became a member of the Royal Society of Victoria in 1860, and served as Honorary Librarian for the following 30 years, campaigning for establishment of a section of the RSV on Literature and Fine Arts. His daughter, Helen Harriet "Nellie" Neild, would later become the Society's first female member in 1889.

With respect to the adoption of the practice of cremation, Dr Neild appreciated that it would take time to change attitudes:

"*The difficulties of making the practice acceptable, are, moreover, increased by the religious complications involved; for I have been told that it is "positively wicked to burn bodies."*

These difficulties, however, are only such as time and a more intelligent consideration of the subject will remove. I do not, as I have already said, expect to see the practice of cremation made general in my own day; but I think it will eventually commend itself for adoption, and only wait its recognition, just as many other social reforms have had to await theirs."

From:
Transactions and Proceedings of the Royal Society of Victoria, Vol XI, 1874. Article X - On the Advantages of Burning the Dead, by James Edward Neild, M.D.

INSPIRING VICTORIA

The **Inspiring Australia strategy** was developed by the Australian Government to increase engagement and interest in the sciences. The **Inspiring Victoria** program is jointly funded by the Australian and Victorian governments with the Royal Society of Victoria.

Inspiring Victoria encourages involvement in STEM through initiatives (such as **National Science Week Victoria**) that are delivered by the RSV's program partners:

- Public Libraries Victoria
- Neighbourhood Houses Victoria
- Parliament of Victoria
- Museums Victoria
- Royal Botanic Gardens Victoria
- The Commissioner for Environmental Sustainability
- Questacon
- The Arthur Rylah Institute for Environmental Research.

NATIONAL SCIENCE WEEK GRANT RECIPIENTS 2023

The Royal Society of Victoria and its Inspiring Victoria partners are delighted to advise that the National Science Week Grant 2023 recipients have been announced by the Federal Minister for Industry and Science, with six major events funded in Victoria:

MULTISENSORY SCIENCE BOOK EXHIBITION FOR BLIND AND LOW VISION PEOPLE

Monash University

PROJECT/EVENT LOCATIONS:
VIC & NSW

'Read' about immune system cells through your sense of touch or learn about food and nutrition through a 3D soundscape. The Multisensory Science Book Exhibition features a series of interactive works designed for late primary through to secondary students with low vision, blindness, and diverse needs. The exhibition explores scientific topics including the importance of human immunity, infection, cancer, nutrition and gut health; and were created by pre-eminent Australian scientists and researchers.

Works will include interactive multisensory books, tactile art, posters, sculptures, and data sonification. The exhibitions will be hosted by project partners and leaders supporting blind and low vision children with special needs, including the Victorian

INSPIRED BY TECH REGIONAL FESTIVAL

DTAC Wangaratta

PROJECT/EVENT LOCATIONS:
VIC

The Inspired By Tech Regional Festival is a suite of events designed to encourage creativity, collaboration and problem solving in both schools and in the wider Wangaratta community. 'Pre-Science Week' activities will provide innovative technology-based learning experiences including challenges, interactive webinars and a community 'Pint of Science' style event. Then a National Science Week showcase event, which will provide an opportunity for students, community members and industry stakeholders to come together, connect, and discover the technology that surrounds them every day. It will also help regional students and their families explore technology as a field of study or career pathway.

THE NATIONAL QUANTUM AND DARK MATTER ROAD TRIP

University of Melbourne

PROJECT/EVENT LOCATIONS:
VIC, NSW & QLD

A band of physicists are taking dark matter on a road trip. The National Quantum and Dark Matter Road Trip is an interactive travelling science and art show, bringing quantum physics, mysterious dark matter particle physics, and creative expression to capital cities, regional and remote areas. Scientists from two ARC Centres of Excellence will visit community hubs in regional Queensland and Victoria, and run public events in other capital cities during a fortnight inclusive of National Science Week.

Dark matter accounts for 85 per cent of all the matter in the Universe...but we don't yet know what it is. Australia is a key player in the quest to find out. Quantum technologies are crucial in the hunt for dark matter, and they're already used in smart phones and cars, medical imaging, manufacturing, and navigation. But today's technologies capture only a small fraction of the potential of quantum physics.

The road tripping scientists will enlighten the public on the importance of fundamental scientific research taking place in their own backyards that are vital to unravelling the mysteries of the Universe.

SHIRTY SCIENCE – FAVOURITE SCIENCE SHIRT

Madison Hartill Law

PROJECT/EVENT LOCATIONS:
ONLINE

Which artist-researcher duo will win the battle to design the top Shirty Science t-shirt?

Scientists from two ARC Centres of Excellence will be paired with artists to create unique science shirts about their research. Each pair will present their final design to the Australian public and a panel of esteemed scientific and creative judges through a live stream event, hoping that their creativity and teamwork will be enough to win them the title of Favourite Science Shirt.

All shirts will be available to purchase online, with profits donated to an organisation that supports diversity and inclusion in STEM.

FOOTY OVAL ASTRONOMY

Mount Burnett Observatory

PROJECT/EVENT LOCATIONS:
VIC & ONLINE

Mount Burnett Observatory volunteers will take over a football oval to run Footy Oval Astronomy – a free event for the local community and emergency services volunteers, bringing the wonders of astronomy to a wide audience, in person and online. Observatory telescopes will be on hand to show visitors the night sky and demonstrate that astronomy is accessible to everyone. This will be complemented by: indoor activities including astronomy talks, computer simulations of the night sky and objects of interest, information on Indigenous astronomy, a live Facebook stream to allow questions and answers throughout the night, a live band, and food vans. The three-hour event will be broadcast via Facebook and on free-to-air television by Channel 31.

BIONICS INSTITUTE 2023 OPEN HOUSE

The Bionics Institute of Australia

PROJECT/EVENT LOCATIONS:
VIC

Find out how biomedical technology is being developed to treat conditions such as dementia, tinnitus, Parkinson's disease, arthritis and hearing impairment. Visitors will meet world-class scientists, engineers and researchers at the Bionics Institute Open House. They can hear how STEM study pathways lead to a career in biotechnology, engineering, neuroscience, data science and more. Tours of the Institute's laboratories will showcase the pioneering biomedical therapies being developed in Melbourne, and how these technologies can change the lives of people living with hearing loss or certain degenerative or neurological diseases.

Guests will learn about the Bionics Institute's track record of translating medical device concepts into clinical reality, dating back to the ground-breaking work of the Institute's founder Professor Graeme Clark, the mind behind the cochlear implant.

Warmest congratulations to all major grant recipients! Keep your eyes peeled for details at the National Science Week website, and don't forget to register your own plans for August to be a part of Australia's longest-running community festival!

The full announcement, including details of events funded in other states, can be viewed at ***www.scienceweek.net.au/national-grant-round-recipients-for-2023/***

CALL FOR SCIENTIFIC PAPERS

The *Proceedings of the Royal Society of Victoria* is our refereed journal, published twice annually by CSIRO Publishing. Current and recent editions are available online in open access format from **publish.csiro.au/rs**.

The Society invites contributions for the *Proceedings* from authors across the various disciplines of biological, physical and earth sciences, including multidisciplinary research, and on issues concerning technology and the applied sciences.

Contributions on topics that are relevant to Victoria and the south-eastern Australian region are encouraged. The journal also publishes Special Issues and themed collections of papers commissioned by the Council of the Royal Society of Victoria. It is published online in May and November, with two issues constituting a volume.

The *Proceedings* is one of Australia's oldest and longest-running science journals, a terrific platform for establishing an individual research presence, grouping papers derived from symposia on specific subjects, or simply joining a distinguished tradition of science published in or about our region that stretches back to the 1850s.

The journal began in 1855 as an irregular publication under the title *Transactions of the Philosophical Society of Victoria*, the present name being adopted in 1889. Since then, the journal has appeared on a regular basis, at first annually but varying from one, two or four parts per year. Since 1889, the parts issued each year were deemed to make up a volume. The online content extends back to Volume 118, Number 1, 2006.

Those interested in submitting papers should review the **Guidelines for Authors**. All enquiries and manuscript submissions should be forwarded via email to **editor@rsv.org.au**.

Please note copies of the *Proceedings* 1854 to 2006 are freely available online at the State Library of Victoria website in their 'Digitised Collections.'

SOCIAL MEDIA

Follow the journal on social media using the hashtag *#ProceedingsRSV*

CURRENT GOVERNMENT CONSULTATIONS OF INTEREST TO VICTORIA'S SCIENCE COMMUNITY

*Projects open for consultation from **engage.vic.gov.au/project***

Victorian Murray Floodplain Restoration Inquiry and Advisory Committee.

Learn about the Standing Inquiry and Advisory Committee appointed to advise on the proposed Victorian Murray Floodplain Restoration Projects and their potential effects

Ongoing:
engage.vic.gov.au/VMFRP-SIAC

Government Land Standing Advisory Committee

Have your say on changes to planning provisions for surplus government land to be sold or land proposed to be acquired for priority projects by the Victorian Government.

Ongoing:
engage.vic.gov.au/glsac

Suburban Rail Loop East

Help us shape the design and plans for building Suburban Rail Loop East

Consultation closes 12 June 2023:
engage.vic.gov.au/suburban-rail-loop-east

Victoria's Strategy Towards Elimination of Seclusion and Restraint.

We welcome your feedback about care and support provided to people with innate variations in their sex characteristics.

Consultation closes 25 June 2023:
engage.vic.gov.au/victorias-strategy-towards-elimination-of-seclusion-and-restraint

Victoria's Intersex Protection System

Have your say on Victoria's 30-year infrastructure strategy which makes recommendations to Parliament on how to get the best use from our existing and new infrastructure.

Consultation closes 18 June 2023:
engage.vic.gov.au/intersex-protection-system

Wilsons Prom

Parks Victoria is engaging with the community about Wilsons Prom

Consultation closes 16 July 2023:
engage.vic.gov.au/wilsons-prom

PITCHING AND WRITING FOR SCIENCE VICTORIA

Science Victoria seeks the discussion and promotion of scientific topics of relevance to people living in the State of Victoria. We are particularly interested in new research, in-depth articles, or exploration of subjects where scientific work and thinking can directly address or deepen our understanding of environmental and socioeconomic challenges.

We welcome your pitches and pieces for news, features, opinion, and analysis articles on current scientific research in Victoria, recent scientific discoveries, related social and policy issues, technical innovations, and overviews of impactful research. We cover a broad range of topics around Science, Technology, Engineering, Mathematics, Medicine/health (STEMM) under an overarching theme of "science and society."

Science Victoria's articles are written in plain, non-academic language, pitched at an intelligent and naturally curious audience that does not necessarily hold subject-matter expertise. This is not a platform for scientific journal articles nor media pieces. For more information on what we're looking for, please read our article submission guidelines below.

HAVE AN IDEA FOR AN ARTICLE?
PITCH YOUR IDEA TO US!
Send your idea to **editor@sciencevictoria.org.au,** along with any questions you have regarding your pitch.

In your email, please outline:
- In one sentence, what is your key message? (No more than 50 words)
- Why should this key message be shared with the readers of *Science Victoria*? (No more than 100 words)
- Which style of article are you proposing to write? (See below for a guide to article types)

Article pitches can be submitted at any time, but please keep in mind the article submission deadlines for the next month's issue. Note that we may accept your pitch, but suggest it is more suitable for another style of article.

ARTICLE SUBMISSION
Once your pitch has been accepted, you can submit completed pieces that comply with the style guide below. Completed articles to be published in the next issue of *Science Victoria* must typically be submitted 2 weeks prior to the beginning of the next month.

All pieces will be reviewed prior to publishing and may be edited for length and clarity (although we will be sure not to alter the message or context of your work). We will also endeavour to fact-check and confirm any grey areas with you ahead of publishing in the interests of accuracy.

All published pieces will be accompanied by a by-line, and a short (<50 word) biography of the author (title, institution, qualifications, current projects, contact email) to be submitted with your piece.

Images and figures to accompany your piece are strongly encouraged, however please ensure that you only provide original images produced by yourself or those that already exist in the Public Domain.

Images must include details of the source and any relevant descriptions. If you do not provide any images, and any relevant descriptions. If you do not provide any images, we may include Public Domain or stock images that we deem suitable for visual communication of your content.

REFERENCES
References for all articles should use a modified APA 7th edition format: reference list in author-year format, with numbered in-text citations. Refer to articles in previous editions for examples, or contact **editor@ScienceVictoria.org.au**.

WRITING FOR SCIENCE VICTORIA: ARTICLE FORMATS

STYLE GUIDE

To successfully engage the largest audience, all pieces should have readability in mind.

Readability can be determined using a Flesch-Kincaid readability test, aiming for a score between 50-60. This score means that your piece should be easily understood by an educated 16-year-old (a year 10 student).

If drafting your piece in Microsoft Word, **you can easily view your document's readability statistics** at Home>Editor>Document Stats. Alternatively, you can use one of the many free online calculators.

FEATURE ARTICLES

Recommended word count (600 - 1,800)

Feature articles are more in-depth pieces on a specific topic related to STEMM. A key aspect of feature articles is the narrative – this isn't a journal article, so think about the story that your article is trying to tell.

Your audience is intelligent members of the general public, who share an enthusiasm for scientific topics, or who are members of the scientific community outside of your particular field.

Avoid using jargon, as it will quickly alienate anyone who isn't an expert in that field. Explaining one or two otherwise irreplaceable terms is fine.

Please reference primary sources/journal articles for any non-trivial scientific claims, or for publications that prompted your writing of the article.

Feature articles typically run between 600 and 1,800 words (including references). Use of sub-headings and figures to break up longer pieces is strongly encouraged.

Not quite sure about the tone for your piece? Have a look at articles published in previous editions of *Science Victoria*, or in other scientific magazines for a general audience, like T*he Conversation, Cosmos, New Scientist* or *Scientific American*. A good litmus test is knowing that most of us have read a piece or been to a presentation that managed to make the most interesting topics incredibly boring. This is what you want to avoid.

LETTERS AND ARTICLES

Recommended word count (400 - 1,000)

Letters have minimal restrictions on style, structure, or subject matter. You are encouraged to submit your thoughts/questions/comments that broadly relate to STEMM in Victoria and/or the Royal Society of Victoria. Potential subject areas include responses to articles in previous editions of *Science Victoria*, seminars at scientific events, science-related issues and policies, or topics you'd like to see in future editions.

Where a specific question is asked, we will endeavour to have the appropriate person respond to your letter.

WHAT I'VE BEEN READING

Recommended word count (400 - 1,000)

This is a column for you to tell us about a book broadly relating to science that you've read. These pieces are typically between 400 – 1,000 words and include a summary of the book and its ideas, as well as your interpretations or conclusions.

Possible questions to consider when writing this column:

- Do you think the author was correct in any assumptions?
- Was the author's style of writing approachable?
- Did they do the subject matter justice?
- Who would you recommend this particular book to?
- What did it mean to you?
- What did you learn?

OPINION ARTICLES

Recommended word count (600 - 1,000)

In contrast to an unbiased news or feature article, an opinion piece conveys your informed opinion on, or experiences with a particular topic. This is where your expertise on a subject can shine. Clearly state your argument, outlining the details of the problem you are addressing, and build to a strong conclusion.

For greatest impact, your choice of topic should be one that is broadly relevant to STEMM-related fields in Victoria. Examples of possible topics include:

- how to address a climate-change related problem in Victoria, successes and failures common to STEMM engagement initiatives,
- changes in your particular field of expertise
- your experiences of a career in STEMM and thoughts on how to better support the next generation of researchers,
- existing STEMM-related studies or approaches that you believe could be applied in Victoria,
- ethical problems related to scientific projects or careers in STEMM.

Please reference primary sources/journal articles for any non-trivial scientific claims, or for publications that prompted your writing of the article.

Opinion pieces should aim to be 600-1000 words. For anything shorter, consider submitting it as a Letter instead. We welcome well-informed opinion articles from all authors, particularly from those with significant expertise in a given area. Articles may reference your own work; however these are not promotional fluff pieces.

NEWS AND ARTICLES

Recommended word count (400 - 1,000)

News Articles are for the discussion of current or recent news relating to science, with an emphasis on science in Victoria or news that impacts Victoria's scientific community.

These articles should be concise, avoid use of jargon and personal opinion, and be referenced as appropriate. News pieces should be between 400-1,000 words in length.

Reports could relate to funding announcements/grant outcomes, new STEMM-related projects, high-impact publications relevant to Victoria, successes of Victorian scientists, or relevant STEMM-related policy news.


THE ROYAL SOCIETY OF VICTORIA
Promotion and Advancement of Science

HOLD YOUR NEXT EVENT AT THE ROYAL SOCIETY OF VICTORIA

The RSV engages communities with scientific knowledge through aligned partnerships, special events, festivals, conferences, and education programs. Email **rsv@rsv.org.au** to discuss your needs and ideas!

FACILITIES FOR HIRE

The Royal Society of Victoria's facilities are available for hire to organisations, companies, or private groups. This heritage-listed building opposite the Carlton Gardens is suitable for a wide range of events, including conferences, seminars, meetings, and private functions.

Limited parking is available on-site and a commercial parking operator is adjacent on La Trobe Street.

The RSV has audio visual and seminar equipment available for use, including videoconferencing facilities. There is a commercial kitchen on the ground floor, suitable for your own use or by a caterer.

SERVICES AVAILABLE

We provide a number of services to ensure your event is a success. Some of the services we provide are:

- Event management
- Meeting venues
- Grants and awards administration
- Social media campaign management
- Broadcasting and video production
- Campaign management
- Recruitment of scientific panels
- Convening community engagement and deliberation processes where scientific work contributes to social, environmental, and economic impacts and benefits.

The Burke and Wills Room

Multi-functional space with adjoining kitchen.

Capacity:

Workshops	≤30 people
Dinners	≤60 people
Seminars, functions, catering, etc	≤80 people

The Von Mueller Room

Seminar room great for smaller meetings and seminars.

Capacity:

Meetings, seminars, etc	≤15 people

The Ellery Lecture Theatre

Raked seating great for lectures, presentations, and conferences.

Capacity:

Raked seating	≤110 people.

The Cudmore Library

A picturesque room great for larger meetings and seminars.

Capacity:

Meetings, seminars, etc	≤24 people

We are registered as a Certified Social Trader working for the benefit of Victorian communities, which makes our services eligible under the Victorian Government's Social Procurement Framework, as well as the social procurement guidelines of the governments of New South Wales and Queensland. Our certification also assures industries of our authenticity in building social procurement into services and supply chains. For more information and bookings please contact our Business Manager at **james@rsv.org.au** or on +61 3 9663 5259

SUPPORT VICTORIA'S SCIENCE SOCIETY

To support our programs with your donation, please fill out this form and return it to the Royal Society of Victoria, 8 La Trobe Street, Melbourne VIC 3000. You can also support our efforts through online donations and bequests at **rsv.org.au/support-the-rsv**

RSV 2023 FUNDRAISING CAMPAIGNS	RSV 2023 FUNDRAISING
The Area of Greatest Need, as identified by the Society's Council	$
Inspiring Victoria – Community Science Engagement Program	$
Science Awards & Prizes	$
Science History & Heritage	$
Science for All - Citizen Science Programs	$
BioQuisitive Community Lab	$
The Phoenix School Program	$
The BrainSTEM Innovation Challenge	$
Australian Indigenous Astronomy	$
Science Victoria - Magazine and Web Content Production	$
TOTAL	**$**

Personal Details

Title: (Circle One) Prof Dr Mr Mrs Ms Miss Other **Family Name:** _____

Given Names: (In Full) _____

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Science Victoria

The Royal Society of Victoria
8 La Trobe Street, Melbourne,
VIC 3000

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