The Royal Society of Victoria
Promoting science since 1854

SCIENCE VICTORIA

NEWS FROM THE ROYAL SOCIETY OF VICTORIA RSV.ORG.AU JUNE 2022

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THE OFFICIAL NEWSLETTER OF RSV

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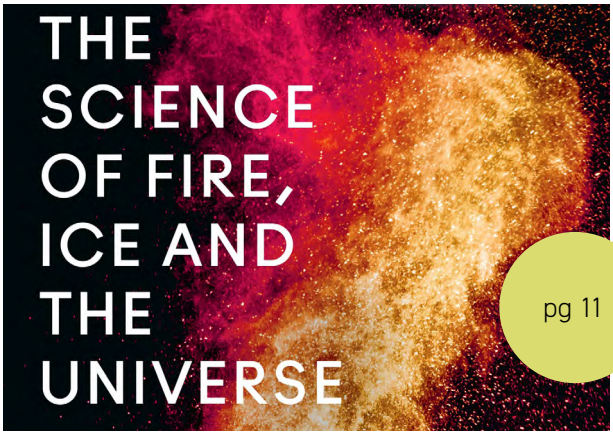

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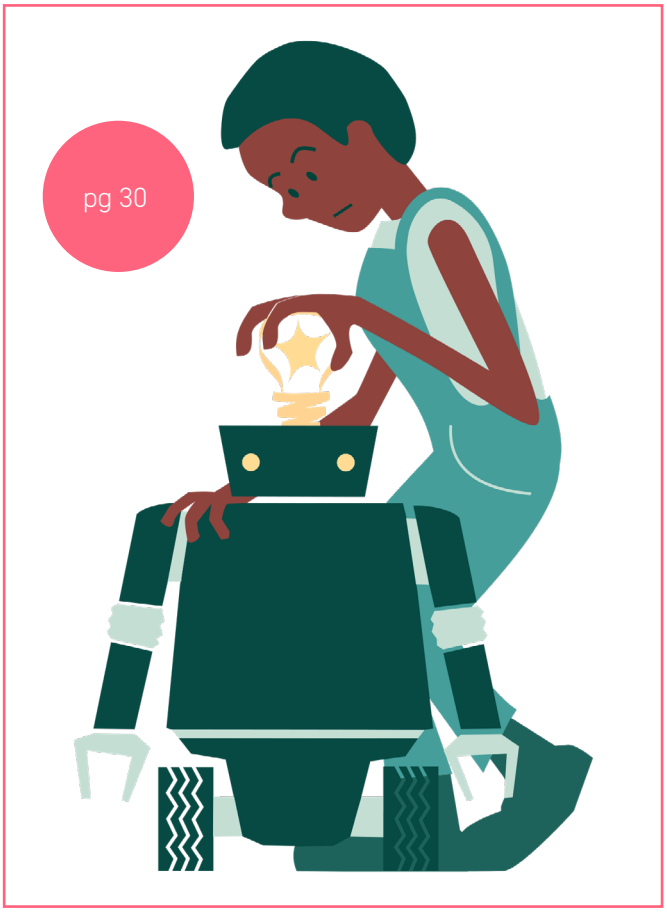
ON THE COVER: Jewel beetles *(Julodimorpha bakewelli)* males attempting to mate with a discarded beer bottle. Females of this species are flightless and considerably larger than the males, hence the attraction to what they see as a very large female. Shark Bay, Western Australia, August 2019. Image credit: IMAGO / Nature Picture Librarys



FROM THE CEO

It's Getting Hot in Here!

This must be how the lobster feels! I can't even process the Federal Election result just yet. At the time of writing, we have a live process underway in delivering our Forum on 4th June and developing the Royal Society of Victoria's position paper on Biodiversity Conservation and Recovery, preparations underway for the National Science Week program in August and the delivery of our Annual General Meeting – there's a definitive "overwhelm" moment in play, so as we publish June's *Science Victoria* it's excellent to draw resolve from the many excellent initiatives demonstrated in the pages of this month's issue.

Despite heading into a winter that will undoubtedly be characterised by the continued toll of the Covid-19 pandemic and the added bonus of a vigorous flu season, we have a strong return to event delivery to celebrate, stretching to offer "hybrid" formats to enable people to join either online or in person, depending on circumstances and preferences.

I'm particularly excited by upcoming lectures on Australia's amazing caves and karst systems with Professor John Webb and a look ahead to building a world-class manufacturing sector in Victoria with CSIRO's Chief Scientist, Professor Bronwyn Fox. We also celebrate World Environment Day with a courageous panel discussion convened by the Parliament of Victoria's team on Sunday, 5th June, featuring our four new RSV Fellows; please tune in to our Facebook page at 3pm to support this effort and contribute your questions via the online broadcast.

There's some great reading in this month's edition and I'm particularly grateful to our various contributors. Whether submitting through letters to the President or in writing topical articles on science and society, we welcome your contribution to future editions; please email us at **rsv@rsv.org.au** with any ideas or fully developed papers for consideration.

Have a great month!

Mike Flattley
CEO, The Royal Society of Victoria

SCIENCE VICTORIA, VOLUME 2, NUMBER 5, JUNE 2022

The Monthly Publication of the Royal Society of Victoria – established 1854 for the promotion and advancement of science.

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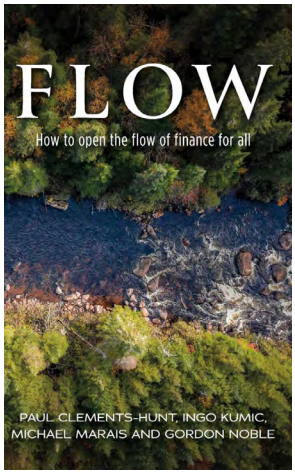
FROM THE PRESIDENT

When Science Meets Finance: Scinance?

What do kastels and livas, AMPOL (Australian Motorists Petrol Company) and the open-source operating system Linux have in common? I didn't know either. They're all innovations that facilitated a valuable transition of resources: water, petrol, and data respectively. They're examples of flows of resources that provide us with illustrative financial models that might provide an open 'flow of finance' to resolve the critical sustainability problems we face today - finance for sustainable development.



Discussion of these matters are the subject of new book, ***'Flow: How to open the flow of finance for all'*** by **Paul Clements-Hunt**, Dr Ingo Kumic, Michael Marais and Gordon Noble. Paul Clements-Hunt first coined the term ESG (Environment, Social, Governance) and delivered the United Nations Principles for Responsible Investment (PRI). Gordon Noble is chairing the RSV's Natural Capital Financing Working Group.

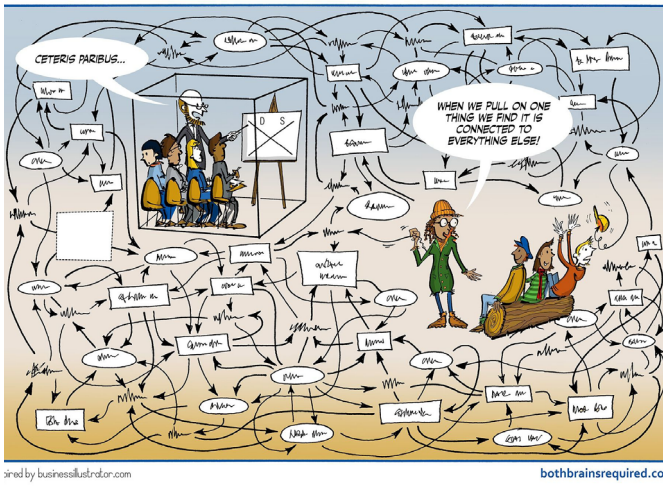
'Flow' is used in the book to introduce the concept of flows of finance for all. The analogy of the underground water tunnels, the *Livas'* of the 5th century city of **Gaziantep** in southern Turkey. For a range of geological, physiographic and climatic reasons the city required water transport, underground. The network brings water from outside the city and distributes it to settlements. The *Kastels* are structures where the water is opened for public use. The *livas*' and *kastels* are recognised by UNESCO as culturally significant. So, in Gaziantep, the flow of water was directed to where it was needed. As water is the key to life, the comparison is made that financial capital is the key to economic life but that today finance is not flowing to everywhere that it is needed. There's silt in the system clogging up good flows.

This analogy using water to explore the need for new models of sustainable finance continues by describing how 'droughts of capital' lead to a loss of system resilience and increase the likelihood of systemic crises. The United Nations Inter-agency Task Force on Financing for Development 2021 report identifies that 'disasters are often the result of decades accumulation of risk within social, economic, financial, environmental and political systems.'

The need to develop these new models to manage the parallel existential crises of anthropogenic global warming and global ecosystem breakdown are central themes in 'Flow'. The need to 'drive to integrate climate-related financial risks into financial system regulation', already active in EU, now in USA and that 'consideration of climate change is no longer voluntary, it is becoming a compulsory activity'.

The authors are optimistic that the G20 Sustainable Finance working group co-chaired by China and the United States of America will be a valuable opportunity to utilise new thinking and new models to address the the critical issues identified in *The Economics of Biodiversity:* **The Dasgupta Review** and the Intergovernmental Panel on Climate Change's 6th Assessment Report. [IPCC Synthesis Report **here**.

For the Royal Society of Victoria, our clear role is in communications, engagement and maintaining that the 'technical science and numbers (must) connect the narrative'. *'Flow'* has much to say about this in the context of the seventeen United Nations Sustainable Development Goals (SDGs) and SDG 17, "Partnerships for the Goals" in particular. This is discussed in terms of 'collaborations, alliances and reference groups' and communities of empathetic thinkers. 'These collectives



are critical to advancing, advocacy, policy and agenda planning'. *'Flow'* references the caravanserai, a house for a group of travellers; 'places where different cultures engaged with each other' facilitating a 'flow of ideas'.

The RSV was founded to bring science and technology into play with business and government to build the functional framework of the City of Melbourne and the State of Victoria. The opportunity now is for the RSV to open its doors and utilise the skills of its membership together with a wider cohort of experts, to become the focal point for collaborative discussion on current matters in science as running discussion as *livas'* flowing to *kastels*. A '4th sector convergence' of private, public and civil sectors in the development of cross-sector approaches to financing and implementation of the SDGs and other critical issues were since can underpin decision-making and the appropriate flow of finance.

Our upcoming Biodiversity Forum on June 4th will utilise this framework, actively exploring these issues and the opportunity to both establish a genuinely helpful RSV 'position' on biodiversity and to properly resource biodiversity conservation.

The incoming Australian Labor government has announced that it will '**establish an independent environment protection agency to enforce national conservation laws and collect data on the plight of the country's wildlife if it wins the election**'. That is now the case. It will be interesting to see if this matter is approached as *ceteris paribus*, "all things being equal", a dominant assumption in mainstream economic thinking, and whether we can ensure that our economists can understand new financial thinking to ensure the proper level of investment in the complexity of our ecological systems.

> *'Flow: How to open the flow of finance for all' is available at* **Amazon**. *(ISBN: 9781667840604)*

I welcome the thoughts and ideas of members on this. How can the RSV operate as a caravanserai, facilitating new thinking and enabling our scientific associations to speak with one voice on these critically important issues? Please contact me at **president@rsv.org.au**. We would like to publish your letters and thoughts on any issues and build a strong, collaborative conversation.

Rob Gell AM MRSV

President

LETTERS

You Can't Bake the Same Cake Twice:

How twins can help us understand what makes us who we are

Professor Jeffrey Craig, Dr Evie Kendal, Associate Professor Neera Bhatia, Dr Namitha Mohandas

We are writing to you to provide RSV members with some interesting new information about how twin studies have revealed unique and important insights into what makes each one of us who we are.

> We are all familiar with the nature versus nurture debate. But what if we told you there is a much-neglected third factor that makes us who we are - nature, nurture, and an element of mystery?

To explain, let's start with twins. Research with twins helps us tease apart the factors that shape our mental and physical character. Identical twins raised together share their genes and their environments. Yet identical twins still show obvious differences. Parents of identical twin toddlers tell us there are a range of differences between them. From size to skin markings and sociability. And some dentists have even refused to believe that twins are identical because of differences in their teeth!

So, what is this mysterious third factor that makes twins and the rest of us innately unique? Researchers refer to it as 'developmental variation'. It turns out that this type of variation affects almost every living thing. This is because developing organisms are not robots progressing along production lines. Genes only specify general rules for how we develop, not precise outcomes. For example, your genes may create the code for how to make a hand but not how to make individual fingerprints. Genes are not micro managers.

So much of how we develop is left to chance and these random processes of development manifest uniquely in each person. As the neuroscientist **Kevin Mitchell said**, 'you can never bake the same cake twice'. Sometimes luck, or factors beyond your control, can lead to a tastier cake, such as a good batch of flour or pulling the cake out of the oven at just the right time.

> There are real-life examples of how developmental variation occurs. In all humans, fertilisation usually happens in the fallopian tubes – the passage from the ovaries, where the eggs are developed, to the womb. The location within the womb at which a fertilised egg implants can affect how well it grows during pregnancy.

Identical twins happen when one fertilised egg, known as an embryo, splits in two. If this occurs before reaching the womb, the two can implant at different locations. Each will then develop together with their own placenta and umbilical cord, the source of nutrients and oxygen needed for survival and growth. And on their journey towards birth, twins can grow at different rates. Together, **these factors** can influence their birthweight.

Infections from the mother can also be passed to only one twin of a pair. **One example** of this is a set of Brazilian twins where one was born with the Zika virus infection. This infection inhibits brain development, which greatly reduces head size. In this case, this resulted in two very different looking but genetically similar babies.

> The implications of developmental variation for human health are significant. For instance, researchers have known for some time that early life factors can influence the risk of long-lasting conditions such as heart disease, anxiety, and allergies. However, placenta size and birth weight are also factors, which means that more research is needed in these areas.

You may wonder whether we can separate the cake of life's three main ingredients: genes, environment, and developmental variation. This remains a goal of many researchers. But just as we can't un-bake a cake to produce flour, eggs, and sugar, we can't completely separate out the factors that make you an individual. Things are complicated because genes, environment and developmental variation interact. For example, developmental variation influences the environment we experience in the womb and biological parents interact with their children with whom they share genes. Genes can also influence us to **seek out specific environments.**

Data from **200,000 twin pairs** showed that genetic factors are not the primary contributor to genetic disease. The effect of environment was even lower and developmental variation was by far the largest contributor. The implications of this are profound. Without specific genes or environments to target, **full disease prevention** may never be possible. But the small contribution of environment in this data does not mean that environments are never important. Extreme environments, such as abuse and trauma, can differ between individuals and populations. For example, half the world lives on **less than $2.50 a day**, and undernutrition causes almost half of all child deaths. Even in Australia, one in three children grow up in families **experiencing adversity** or in situations of **domestic abuse**. Both exposures increase their chances of having problems with learning or mental health.

The extent to which we are influenced by developmental variation confirms what researchers already knew but frequently forget: data from population studies cannot be applied to individuals. It is impossible to say how much each of us is influenced by genes, environment, and developmental variation. There is no 'average' individual, and we are all truly unique - baked to our own perfection.

So, what does this mean for people hoping to give their children the best start to life? You are doing the right thing and you can make a difference. Watch with wonder as you see your own genetics reflected in your children and expect the unexpected.

Professor Jeffrey Craig, Dr Evie Kendal, Associate Professor Neera Bhatia, Dr Namitha Mohandas

RSV Symposium — "Next-generation biocontrol of invasive vertebrate pests"

The impact of invasive species has been a substantial media topic of late due to the considerable threat posed to ecology and biodiversity across Australia. Traditional methods of population suppression such as poisoning, shooting, and trapping are not only resource intensive but are often not very effective or capable of reducing populations to the extent required to safeguard environmental systems. There are also considerable concerns for animal welfare, and these techniques don't discriminate very effectively between the target species and other wildlife. Evidently, new population management tools are needed.

This RSV-sponsored workshop will discuss the present status of next-generation technologies for the management of invasive vertebrate pests. We are defining next-generation biocontrol technologies as the engineering either of pathogens (e.g. viruses or bacteria) or of the pest species themselves (genetic biocontrol strategies such as "gene drive") to supress populations of overabundant invasive species. Unlike traditional management technologies, next-generation biocontrol aims to be species-specific, with higher concern for welfare outcomes and the potential for complete population eradication.

This workshop will bring together experts in the fields of genetics, reproduction, and ecology to discuss the status of these emerging technologies. This workshop aims to stimulate discussion between various groups including scientists, the public, First Nations peoples, industry, government agencies, and conservation and animal welfare groups.

Next-generation biocontrol clearly presents many new social, ethical, and biosecurity issues that are likely to attract public scrutiny. While the perception of genetically modified food has undergone major transitions in public opinion over recent decades, genetically modified animals is a new proposition that has not received the same attention in public discourse. We hope that this symposium will stimulate an open, productive, and informed general discussion on next-generation biocontrol.

This proposal has garnered preliminary support from other bodies, including RSPCA Vic, the University of Melbourne, and RMIT. It is our intention to include important governmental agencies, such as DELWP, and wildlife and agricultural experts including Melbourne Zoo and CSIRO's Centre for Invasive Species Solutions.

This Workshop will take place on **Friday September 16, 2022.** It is our intention that RSV membership is fully involved with the workshop which will be open to public attendance. The remit of the RSV is to present important scientific concepts to the public for discussion. Many aspects of next-generation pest management techniques are still in their infancy, and responsible communication surrounding this topic is essential.

The conference will seek to cover the following themes:

- The impact of invasive vertebrate pests in Australia
- Next-generation biocontrol technologies currently in use or development for invasive species
- Population modelling and deployment strategies of next-generation pest management techniques
- Ethical and biosecurity challenges of next-generation pest management techniques

Further details of the content of the Workshop will follow shortly. We encourage members of the RSV to be involved and would appreciate all feedback and suggestions during the organisation process.

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Ellen Cottingham
The University of Melbourne
ellen.cottingham@unimelb.edu.au

RSV NEWS AND NOTICES

New RSV Members

Dr Jing Hong Fong
Medical Doctor, North West Regional Hospital, Tasmania

Mr Aung Zaw Zaw Phyo
PhD Candidate, Monash University

Mr Pui Kwan Cheung
PhD Candidate, The University of Melbourne

Mrs Balinee Balachandran
PhD Candidate, Monash University

Dr Roger Dargaville
Senior Lecturer, Monash University and President, Australian Meteorological and Oceanographic Society

Dr Ramakrishna Rao Muthyala
Retired Author & Geographer

Mr Isaac Alexander,
Secondary Student, Kardinia International CollegeProfessor

Jeffrey Craig,
Epigeneticist & Cell Biologist, Deakin University

Miss Khatereh Edalati,
PhD Candidate, The University of Melbourne

Ms Diji Kuriakose, PhD
Candidate, Monash University

Dr Stewart Gill,
Master, Queens College

Dr David Wilson,
Geographer & Educator, The University of Melbourne

Mr Sunil Mehla,
PhD Candidate, RMIT University

Unless Members request a ballot, these will be considered by Council and, if elected, will be confirmed at the next Ordinary Meeting of the Royal Society of Victoria.

New RSV Councillor – Dr Djuke Veldhuis MRSV

We are delighted to announce Dr Djuke Veldhuis has been co-opted by the Council of the Royal Society of Victoria as a fellow Councillor. In taking up a vacant position on Council, Djuke's current tenure will persist until the Annual General Meeting to be held in May 2024.

Djuke is the Director of the Advanced Science – Global Challenges course at Monash University and passionate about engaging at the intersection of science and society. She holds a BA (Hons) in Archaeology & Anthropology and a PhD in Biological Anthropology from the University of Cambridge and an MA in Science Journalism from City, University of London.

Her research involves analyses with a combination of qualitative and quantitative data and a variety of statistical techniques. Djuke's doctoral research in Papua New Guinea combined quantitative stress hormone measures with subjective markers of economic and psychological wellbeing. Her research in Alaska takes as its starting point that many environmental and social problems, from air pollution to overfishing, are the result of a breakdown in cooperation. Using traditional economic games in combination with an ethnographic approach the aim is to understand how factors such as competition, punishment and reputation can influence the ability of communities to tackle environmental problems. Both projects involve extensive bilateral engagement with NGOs, health professionals and community leaders to build up local capacity and trust.

She has also developed and delivered science communications training to hundreds of people across the globe. Previous roles include managing FameLab, an international science communication competition in partnership with Cheltenham Festivals, The British Council and NASA, as well as work with the US Global Development Lab's "Partnership for enhanced engagement in research."

WHAT I'VE BEEN READING

Thoughts and reflections from Members of the Royal Society of Victoria.

The Laws that Govern Everything

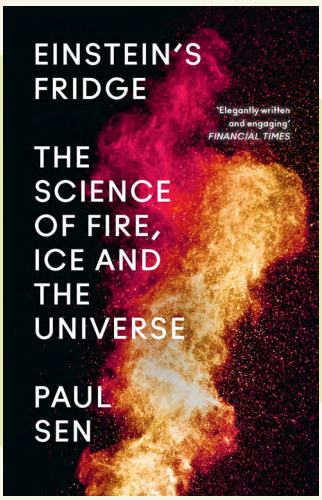
The historical development of the laws of thermodynamics

By Kevin Orrman-Rossiter MRSV

Einstein's Fridge: The Science of Fire, Ice and The Universe

Paul Sen

William Collins (London; 2021), $32.99 pb, 305 pp, 9780008262808

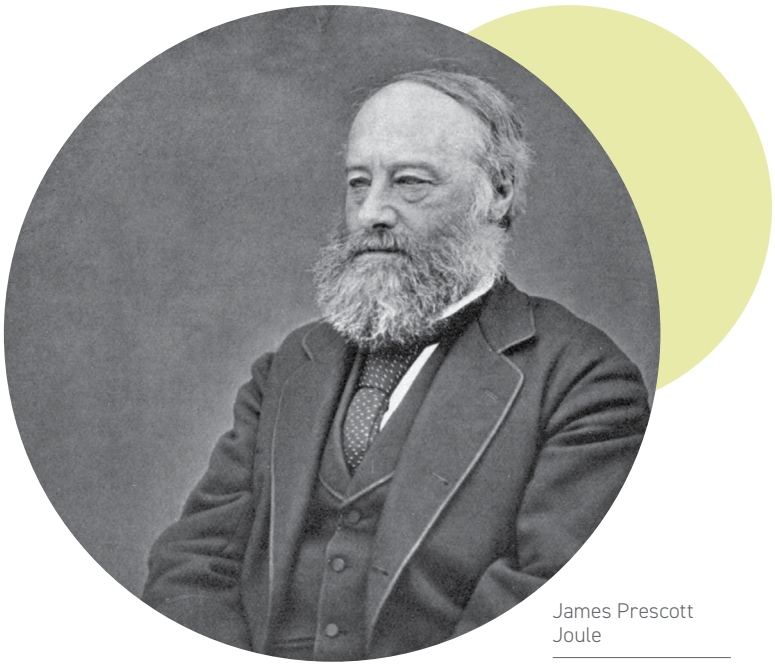


Albert Einstein is arguably one of the most renowned scientists ever. The scientific bedrock of his fame is his Relativity theories. So, the title of this book, *Einstein's Fridge*, may present at first a puzzle to a prospective reader. The puzzle is easily explained by the second part of the title, *The science of fire, ice and the universe*, as this lucid and entertaining book celebrates thermodynamics and its importance to fundamental science and our society. Paul Sen provides a fascinating view of the development of the laws of thermodynamics from an historical perspective, showing along the way how these laws govern the engines that power our world (including living cells and the behaviour of atoms) to the esoteric science of black holes.

The book divides roughly into three parts, covering the discovery of energy and entropy, classical thermodynamics and, thirdly, the consequences of thermodynamics.

If you, like myself, were at first unintentionally cringing after ploughing through thermodynamics and statistical mechanics as undergraduate science subjects, be heartened, and read on. Sen nicely positions the subject in his preface by saying 'thermodynamics is a dreadful name for what is arguably the most useful and universal scientific theory ever conceived.' Continuing to argue that since its discovery 'we have seen the greatest improvement in the human condition in the history of our species,' Sen bookends this proposition with a concession that some readers may find that his 'enthusiasm for scientific and technological progress' misses the critical point of the damage that this industrialisation has caused to the environment. He adroitly then tells the parallel story of the Victorian scientist John Tyndall, who, while studying the thermodynamics of the atmosphere in the early 1860s, discovered the greenhouse effect, amongst other things. He argues that this demonstrates the intertwining of cause and effect in science and that the main obstacle dealing with climate change is not scientific – it is political and emotional.

The bookends of Prologue and Epilogue aside, the substantive 19 chapters that make up the book are a worthwhile read – including for those who studied thermodynamics at university. It starts with the Napoleonic tour of Britain in 1814 by Frenchman Jean-Baptiste Say. Say's 1816 report spurred a technology drive in France that bought with it a development in scientific and mathematical study and education of 'heat' and 'temperature'. From this emerged several key ideas and papers – one favourite being *Reflections on the Motive Power of Fire* by Sadi Carnot. This in turn influenced the thinking and tinkering of British and German luminaries (pun intended) such as James Prescott Joule and William Thomson (later ennobled as Lord Kelvin for his contribution to science), Hermann von Helmholtz and Rudolf Clausius.



James Prescott Joule

These early chapters demonstrate a strength in Sen's book for general readers. Sen not only presents their scientific and engineering arguments and achievements (more complete technical descriptions are included as Appendices so as not to break the narrative flow), but also explores the social context of these people and their developments; for example, charting Joule's challenges, over several decades, to get his ground-breaking work heard at scientific meetings such as the *British Association for the Advancement of Science* and published in the prestigious *Transactions of the Royal Society*. While on his honeymoon, Joule 'ran into' William Thomson at the Alpine resort of Chamonix. Joule at the time had left his bride in a nearby carriage while he attempted to measure the temperature of water at the top and bottom of a waterfall to confirm his idea that it would be warmer at the bottom because energy was converted from potential to heat. This anecdote, Sen concedes, may have been concocted by Thomson to demonstrate Joule's unwavering commitment to science and his connection to Joule's thinking. This is a small example of Sen enlivening the science with the characters of the era, connecting the science with its social context rather than presenting it as remote set of theories, facts, or experiments.

The book is evenly spread from the early days of classical thermodynamics to its latter intersection with modern theories of Relativity and Quantum Mechanics via James Clerk Maxwell, Ludwig Boltzmann, and Max Planck. While some of this may be familiar from other books on science in the 20th century, Sen's presentation is quite unique in showing the relationships of thermodynamics to Einstein's works of 1905 and 1915 (Brownian motion, photoelectric effect and theories of Special and General Relativity), information and system theories of Claude Shannon and Alan Turing and, finally, the Black holes of Karl Schwarzschild, Stephen Hawking, John Wheeler and Jacob Bekenstein. It is quite a tour.

Oh, wait - "Einstein's Fridge," you ask? In amongst some startling physics, Albert Einstein and his friend Leo Szilard (who in 1933 conceived the nuclear chain reaction and in 1934 patented the idea of a nuclear fission reactor) had 45 patents together on refrigerator design leading to prototype designs in 1933 from AEG – the royalties from which Szilard used to support himself while tirelessly working to assist others escape the Nazi regime in Germany. Science, I would argue, is even more fascinating and usefully described when it is situated in its social context. Sen achieves this with this book on thermodynamics.

EVENTS

STEM & Society: Biodiversity Conservation & Recovery in Victoria

3:00PM AEST on Sunday, 5th June

A public presentation by the Parliament of Victoria with the Royal Society of Victoria and the Victorian Parliamentarians for STEM for World Environment Day.

There is nothing more important to humanity's continued existence than sustaining a healthy natural environment. Yet despite efforts in recent decades, many native plant and animal species remain under threat as Victoria's biodiversity continues to decline.

Governments are good at creating legislation, setting goals and formulating policies to achieve them – this is their core role. But with a problem as big as the survival of the natural world against the continued loss of habitat, species overexploitation, ecosystem pollution, spread of disease and invasive species, and the impacts of climate change, we will need all sectors of our society to prioritise and commit to protecting and recovering our biodiversity in partnership. Each of us have a role to play; we just need to define and align these to gain the best outcomes from available resources.

This World Environment Day, join leaders from across four sectors of Victorian society – government, industry, community and academia – who will provide their perspectives on protecting and recovering Victoria's biodiversity. We will explore:

- initiatives within the private sector to invest in and protect natural systems;
- opportunities for First Nations peoples to restore relationships with Country as a feature of cultural landscape management and the unfolding process of reconciliation and decolonisation;
- and, a range of tried and tested, science-based interventions and investment tools to guide and resource local people in restoring ecological health to Victorian regions.

WORLD ENVIRONMENT DAY | UN environment programme

Most importantly, we will discuss how these can all integrate to meet the goals set out in Biodiversity 2037, Victoria's ambitious plan to stop the decline of our biodiversity and ensure that our natural environment is healthy, valued and actively cared for by everyone.

SPEAKERS:

Ms Fern Hames FRSV, Director, Arthur Rylah Institute for Environmental Research (Department of Environment, Land, Water and Planning)

Mr Damein Bell FRSV, Atlantic Fellow and previously CEO, Gunditj Mirring Traditional Owners Aboriginal Corporation

Ms Judith Downes FRSV, Chair, Bank Australia, immediate past Chair of the Global Alliance for Banking on Values Governing Board Forum, and a Director for ImpediMed

Professor Brendan Wintle FRSV, Conservation Ecologist and previously Director, Threatened Species Recovery Hub, The University of Melbourne

Please note: this public discussion will be livestreamed via Facebook Live on the pages of the **Parliament of Victoria** and the **Royal Society of Victoria**; please tune in at **3:00PM AEST on Sunday, 5th June** to follow the broadcast and submit your questions for the panel.

Members of the Royal Society of Victoria are also warmly invited to join the audience at Parliament House, in-person at Queens' Hall; **numbers are strictly limited, so please book early** using the registration page at **https://rsv.org.au/events/stem-society-biodiversity/** The ticket option will only be available once your members' promo/access code has been entered. Please **contact the Society** if you are unsure of your code. If you are not a member, but would like to join the Society, please refer to our **membership page.**

Presented by the Parliament of Victoria and the Victorian Parliamentarians for STEM in partnership with the Royal Society of Victoria. A part of the **Inspiring Victoria** program.

Parliament of Victoria

The Royal Society OF VICTORIA
Promoting science since 1854

Inspiring AUSTRALIA Victoria

Wild Restoration – Organ Pipes National Park

Saturday, 11th June 2022 (10am -4pm)

ORGAN PIPES NATIONAL PARK (ORGAN PIPES RD, KEILOR NORTH VIC 3036)

Get involved in citizen science, restoring native habitat and recovering threatened species.

Come and learn how to get involved in restoring native habitat and recovering our local species while learning valuable citizen science skills at Organ Pipes National Park!

Hear from local experts and learn about the history of the Organ Pipes, using environmental DNA sampling to find local species, hear from Wurundjeri elders and get involved in restoring habitat and growing native plants.

Activities for all ages and abilities, with snacks and face painting provided!

We can bring a limited number of people with us by shuttle bus (pickup/drop-off at the Melbourne CBD or at Sunshine Station, Sunshine) or else you can get yourself there under your own steam.

For a detailed and up-to-date itinerary, please visit **https://ScienceForAll.World/Events .**

This event is run by Science for All with the support of the Royal Society of Victoria and the Nature Stewards program, jointly funded by a grant from Brimbank City Council, Inspiring Victoria and public donations. Our thanks to the Friends of the Organ Pipes National Park for their support of this event.

Please register to attend so we can manage numbers on the day: **https://rsv.org.au/events/wild-restoration/ .**

Australian Caves – Diversity, Wonder And Risk

24th June at 6:30pm AEST

The Australian continent is not well-endowed with caves on a world scale, but Australian caves are notable for their diversity (greater than any other area of equivalent size on Earth), which reflects variety in carbonate rock types, climate, vegetation and geological history. Australian karst has something for everyone, from the razor-sharp towers of north Queensland to the cold, deep shafts of southwest Tasmania, the carbonate dunes of southwest Western Australia, the clear cenote lakes of southeastern South Australia and the ancient reefs of northwest Western Australia.

> Australian caves are wonderful, both in terms of their visual impact and their scientific importance. They contain bat colonies that consume hundreds of kilograms of insects each night, a globally exceptional invertebrate fauna, vertebrate fossils that record animals and environments for at least the last 25 million years, and calcite speleothems that preserve detailed records of past climates.

And Australian caves have risks. There are inherent dangers in exploring caves, including cold, heat, falls and getting stuck, but there are very few accidents in Australian caves because organised trips must have an experienced leader and appropriate equipment. Some caves themselves have been at risk from overuse and threats like limestone quarries.

Join Professor John Webb, who will cover all these aspects and give examples from his own experience.

ABOUT THE SPEAKER:

Professor John Webb is Professor of Environmental Geoscience at La Trobe University. His geomorphological interests centre on karst, and he is principal editor (with Susan White and Garry K. Smith) of *Australian Caves and Karst Systems*, in the book series *Cave and Karst Systems of the World*, soon to be published by Springer.

He also works on tectonic geomorphology and the interaction between landscape evolution and human settlement, and he has studied the geomorphology of archaeological sites in Australia, Jordan, China, Papua New Guinea and New Caledonia. In addition, he specialises in groundwater and contaminated site management, with on-going research projects on improving treatment procedures for acid mine drainage and on the influence of climate and land-use change on groundwater.

Tickets are available from **https://rsv.org.au/events/australian-caves/** to either attend in person or participate via Zoom. RSV and GSAV Members are prompted to **enter their "promo code" to access a member's ticket.** Alternatively, you can watch along via our **YouTube channel** at the appointed time without buying a ticket.

Streamed online as part of the **Inspiring Victoria** initiative in 2022.

Inspiring Australia Victoria

International Year of Caves and Karst 2021

Union Internationale de Spéléologie

Geological Society of Australia

Creating a World Leading Manufacturing Sector in Victoria

Thursday, 7 July, 2022 from 6:00pm

PRESENTED IN PARTNERSHIP WITH THE AUSTRALIAN ACADEMY OF TECHNOLOGY & ENGINEERING (VICTORIA DIVISION).

Australia's mining sector is incredibly advanced in its use of digitisation, automation, and control. What are the success stories, and how can we apply this technology in our manufacturing sector to create something that is world leading?

Join CSIRO's Chief Scientist, **Professor Bronwyn Fox** to explore the reapplication of engineering know-how, as well as opportunities for Victoria at the intersection of manufacturing and hydrogen, followed by a panel discussion with **Dr Amanda Caples**, Victoria's Lead Scientist, and **Mr Rob Gell AM**, President of the Royal Society of Victoria.

ABOUT THE SPEAKER

Professor Bronwyn Fox is Chief Scientist of CSIRO, Australia's national science agency and innovation catalyst.

Professor Bronwyn Fox joined CSIRO in October 2021 and became CSIRO's fourth female Chief Scientist. She is known globally as a leader in advanced manufacturing, materials science, and industry 4.0 technologies, and is passionate about bringing together multidisciplinary teams for collaborative research.

She was formerly Deputy Vice-Chancellor (Research and Enterprise) at Swinburne University of Technology and founding Director of Swinburne's Manufacturing Futures Research Institute. During that time, she established a world first Industry 4.0 Testlab for the additive manufacturing of carbon fibre composites, in collaboration with CSIRO.

Bronwyn has demonstrated a sustained commitment to support the growth of the carbon fibre and composite industry in Australia through targeted research and was previously a co-founder of the Carbon Nexus facility at Deakin University.

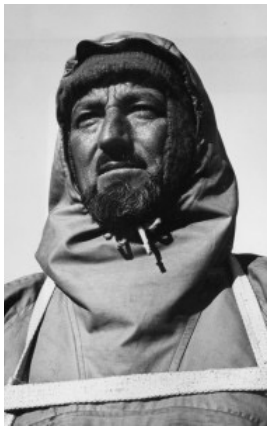
In 2018 she was awarded the Global Congress on Manufacturing and Management Research Leadership Award, and in 2020 she was awarded the Royal Society of Victoria's **Medal for Excellence** in Scientific Research.

Tickets are available from **https://rsv.org.au/events/manufacturing-sector/** to either attend in person (first window) or participate in the webinar via Zoom and/or Eventbrite (second window). RSV and ATSE Members are prompted to enter their "promo code" to access a member's ticket. Alternatively, you can just watch along via our **YouTube channel** at the appointed time without buying a ticket. Streamed online as part of the **Inspiring Victoria** initiative in 2022.

Inspiring AUSTRALIA Victoria

AWARDS, PRIZES AND FELLOWSHIPS

Call for Nominations - 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 and initially awarded exclusively in the physical sciences, from 2021 this award has commenced a cycle through four different categories of science each year.

In 2022, the award is open to suitably qualified post-doctoral candidates in **Category III: Earth Sciences**. This category incorporates Geology, Geochemistry, Geochronology, Geophysics, Planetary Physics, Meteorology, Oceanography, Physical Geography, Palaeontology and related sciences.

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 eligibility.

APPLICATIONS:

Open on **1 June, 2022** and close at **5pm** on **31 July, 2022.** 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 $3000.

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, 27 October 2022.** This will be professionally filmed and shared online. If COVID-19 conditions prevent the event from proceeding, then 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 .**

Call for Nominations - RSV Medal for Excellence in Scientific Research 2022

Our 2021 Research Medal Winner, Professor Andy Ball, with the Victorian Minister for Energy, Environment and Climate Change, The Hon. Lily D'Ambrosio MP

Nominations are invited for the Royal Society of Victoria Medal for Excellence in Scientific Research 2022 in **Category II: Biomedical & Health Sciences.**

This category includes research in the disciplines of Genetics, Immunology, Human Physiology, Human Anatomy, Pathology, Neurology, Epidemiology, Endocrinology, Radiology, Microbiology, Medical Parasitology, Nuclear Medicine, and related human sciences.

The last Medal recipients in this category were Professors Anthony Burkitt and Jamie Rossjohn (2018).

AWARD CRITERIA:

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 Australia (including its territories), or on Australia, with preference for work done in Victoria, or on Victoria.

NOMINATIONS:

Nominations open on 31 March, 2022 and close at 5pm on 31 July, 2022.

- Candidates cannot nominate themselves.
- Scientific Societies, Academies, Universities, Research Institutes, CSIRO, and Members of the Royal Society of Victoria are invited to make nominations.
- The nomination statement should demonstrate the candidate's:

1. **Exemplary publication track record** during the ten-year period from 1st January 2012 to 31st December 2021. The track record will be judged on papers published and/or accepted for publication in refereed international journals. Work outside the ten-year period will not be considered, subject to due consideration of career breaks for primary care responsibilities.
2. **Consistent excellence** in innovation or ground-breaking research and patents, incorporating novel scientific techniques and methods – described in plain language.
3. **Exemplary leadership in science** incorporating evidence of a major contribution to the public promotion of science, advocacy for science, partnership building, collaborations, role modelling and influence across the scientific community.

SUBMISSIONS:

The submission should consist of:

- The nomination statement, signed by the nominator, covering points 1 to 3 above. This must be in Times New Roman, 11 point, and no more than three A4 pages please.
- A brief (no more than five A4 pages) Curriculum Vitae of the candidate. A list of publications, attached in supplement, should be constrained to the ten year period from **1st January 2012 to 31st December 2021.**

The nomination submission should in the form of a single PDF file sent via email, attention to the Chief Executive Officer, at **rsv@rsv.org.au**

CONDITIONS:

The Royal Society of Victoria reserves the right to seek independent referees in considering the nominations received, and not to consider nominations that do not comply with the nomination format or do not address the award criteria.

If no candidate of sufficient merit is nominated, no award need be made in a particular year.

No posthumous award will be made.

THE AWARD:

The successful candidate will receive an engraved silver medal which is presented by the Society's patron, the Governor of Victoria or, in the event of Her Excellency's unavailability, a senior leader of Victoria's government or science community.

The medallist will be required to present a lecture to the Society Members and guests on the evening of Thursday, 8th December 2022 at which the Medal will be presented.

ENQUIRIES:

CEO, The Royal Society of Victoria, 8 La Trobe Street, Melbourne 3000 Telephone: (03) 9663 5259, or via **rsv@rsv.org.au.**

2018 RSV Medallists Professor Anthony Burkitt (left) and Professor Jamie Rossjohn (right) with Her Excellency the Honourable Linda Dessau AC, Governor of Victoria (centre)

TRANSACTIONS

FEATURES AND ARTICLES

ABC Radio National's Tegan Tayor, host of Ockham's Razor and MC for the evening.

Ockham's Razor at the Royal Society of Victoria

The simplest explanation is often the best. ABC Radio National's Ockham's Razor has returned to the Royal Society of Victoria. Seven incredible tales of science and endeavour were presented at the podcast and recorded for the podcast live. Hosted by Tegan Taylor and produced by James Bullen, Ockham's Razor is a soap box for all things scientific. The following articles are a teaser for the episodes that are to come. While they are based on the presentations delivered and recorded for the program, they do not cover all points from the speakers but do provide additional information. Stay tuned for each presentation that will be released as a podcast episode in the coming weeks: **https://www.abc.net.au/radionational/programs/ockhamsrazor/**

THE DIFFICULTIES OF SEX

Professor Bob Wong (Monash University)

Sex is difficult – even at the best of times. Unrequited love is hard. And human activity can create barriers to make it even harder for other animals.

Animals are choosy when it comes to selecting a sexual partner, and usually it is the females who tend to choose. Females are selective about their choice of sexual partner. They may seek superior territory, food security, nurturing fathers, or good genes.

Males across the animal kingdom have evolved traits that help them be chosen: striking colours, elaborate tails, beautiful song, and others. The advantages provided by these traits increase reproductive success and are therefore selectively passed down generations in a process called sexual selection.

Sexual selection can occur both intra- and inter-sexually. During intrasexual selection, members of the same sex attempt to outcompete rivals for mates. This is typically responsible the evolution of armaments to increase their chances of success such as larger beetle horns and deer antlers, or larger body size. By contrast, intersexual selection results from mate choice, where certain behaviours or characteristics (e.g. mating calls and bright colours) are considered ideal.

> But human waste can interfere with this process.

Invasive species brought by people into new areas are detrimental to native flora and fauna, urbanisation drowns out mating calls, and pharmacological waste changes reproductive behaviours of aquatic life. Plus, climate change makes things difficult for all species.

Human waste impacting the reproductive success of other animals is not a recent phenomenon. Last decade, ecologists on a field trip in WA found golden brown beer bottles strewn across the ground – with which male Australian jewel beetles were attempting to mate. The similarity of these "empties", in both colour and texture, to the female Australia jewel beetle is striking. Because the bottles were larger, they were 'super sexy stimuli' for the males. Not only did this mean that males were confused and not successfully mating, but they were also more vulnerable to predators in the time that they desperately clung on to bottles.

While beer bottles have since been changed, more recently, Bob has been interested in emerging contaminants that pollute our waterways.

> Prescription drugs enter our water supply as people release trace amounts in their urine or flat-out flush unused medication down the sink or toilet. Around 50-60% of the active ingredients of some pharmaceuticals are flushed out away, such as oestrogen in the birth control pill. We are literally medicating our waterways.

A major problem with pharmaceuticals is that the receptors on our cells that drugs are designed to target tend to be evolutionarily conserved among different animal groups. Medicines that are developed for humans can therefore also have the same or a similar effect on other species – like fish.

Bob and other researchers around the world have seen abnormalities in the genitalia of both terrestrial and aquatic life due to exposure to drugs that interfere with the reproductive hormone system (endocrine-disrupters) like oestrogen and the plasticizer, BPA. These endocrine-disrupters are feminising male fish, alligators, turtles and frogs, such that it becomes difficult for them to reproduce. Entire species are at risk.

But it is not all bad news. As an example of where our waste is not entirely negative, in Mexico, some birds are incorporating cigarette butt fibres into their nests to aid fledgling success as the chemicals inhibit the growth of nest parasites. In addition, some birds incorporate colour from straws, glass, and plastic in their nests.

It is important to remember that no species exists in a vacuum. Reproduction is essential for the survival of animals and conservation of biodiversity, yet it is easily disturbed by our actions. We should not be making sex any harder.

THE SCIENCE DOUGHNUT

Dr Emily Finch (Australia's Nuclear Science and Technology Organisation)

The world still has not yet ended. It did not end in 2008 when the world's largest and most powerful particle accelerator was switched on in Geneva. Sensationalist new reports speculated that the Large Hadron Collider would create a black hole that would swallow surrounding matter faster and faster until it devoured the entire planet.

Emily works at a similar particle accelerator here in Melbourne: the Australian Synchrotron. But given that you are reading this, these immensely powerful machines have clearly not brought about doomsday.

Particle accelerators like the Large Hadron Collider and the Australian Synchrotron propel charged particles at high speeds and channel them into a beam. They then smash them into targets or other particles zipping in the opposite direction. By studying these collisions,

physicists can probe the world of the infinitely small. While the Large Hadron Collider uses positive protons, the Australian synchrotron smashes negative electrons together, both using the same principles.

> Emily likens the synchrotron – or as it is affectionately known, the Science Doughnut – to a racetrack. F1 enthusiasts love to watch race cars whizzing around a track at 300 km/h, but the circular synchrotron, 216 m in circumference, has electrons zipping around a thousand times faster at just under the speed of light.

The particles travel as a beam inside a vacuum so that no air or dust can obstruct their path. At the Australian Synchrotron, electrons are shot out from an electron gun so that they are already travelling at over half the speed of light. They are then sped up further until they nearly reach the speed of light and are shot out into an inner "booster ring" to boost their energy. Once the electrons have gained enough energy, they are shot into an outer ring. Hence the affectionate nickname – the two rings form a doughnut.

Electrons travel in straight lines. But the synchrotron is circular. To force electrons around corners, their path is bent with a series of magnets. As they bounce around corners, the electrons produce a beam of light known as synchrotron light. This light is one million times brighter than the Sun, and scientists like Emily measure how it interacts with different samples to determine their composition or atomic structure.

> Particle accelerators like this have contributed immensely to basic science as well as many varied applications. They provide answers to fundamental questions about the universe and shed light on physical laws that govern matter, energy, space, and time. Accelerators are also used in interdisciplinary science that brings together many scientific fields such as biology, medicine, material science, physics and chemistry.

In 2020, the Australian Synchrotron was used to zoom the SARS-CoV-2 virus. The spikes that give the coronavirus its name – corona or crown – are proteins that the virus uses to enter our cells. They do so by interacting with receptors on our cells similar to a key opening a lock. By using the synchrotron to study this interaction, researchers could learn about how infection occurs and how to block it.

The synchrotron was also used to reveal a hidden painting underneath the 19th century brushstrokes of Edgar Degas' Portrait of a Woman. The synchrotron scanned the painting, firing an intense beam of charged particles into the canvas without damaging it. The beam excited individual metal atoms in the layers of paint, allowing scientists to determine the composition and colour of the picture that lies beneath.

The Australian Synchrotron is therefore one of Australia's most significant pieces of infrastructure and a hub of innovation. More than 5000 researchers use it per year, and its powerful beams of light illuminate the molecular and atomic details of a wide range of materials.

SEEING THE INVISIBLE SKY

Professor Virginia Kilborn (Swinburne University)

Away from bright city lights, thousands of stars and the occasional planet become visible in the sky. We see bright patches of sky lit up by stars that are larger and brighter than our Sun. We see dark patches where their light is blocked by dust. We see coloured stars at different temperatures and stages of life; red, yellow, white, blue, or in between.

While we can see the billions of stars that comprise the Milky Way and maybe even sometimes make out our neighbouring galaxies, the Clouds of Magellan, Virginia is more interested in the galaxies that lie beyond.

Astronomers build telescopes to search for cosmic radio waves and learn about the universe. Radio telescopes "see" the sky very differently to the point-like stars seen in visible light. They detect black holes, stars and planets being born, dying stars, and more. They detect invisible gas and can reveal areas of space that may be otherwise obscured by cosmic dust.

Radio emission is common in the universe, radiating from charged particles as they accelerate. It is generated by everything from planets and stars, black holes and quasars (the brightest, most distant objects in the universe, powered by supermassive black holes), and whole galaxies. Astronomers use these waves to learn about their composition, structure and motion.

Radio waves have the longest wavelengths in the electromagnetic spectrum. Specially designed telescopes observe long wavelengths of light ranging from 1 mm to over 20 m. (For comparison, visible light waves are only a few hundred nanometres long – thinner than a hundredth of a sheet of paper.)

Given that radio waves are longer than optical waves, radio telescopes need to be physically larger than standard optical telescopes to achieve the same resolution. The Parkes radio telescope has a dish 64m wide but cannot yield an image any clearer than a small backyard telescope. This conundrum was overcome by combining the views of several antennae spread over a large area in an array to work together as one giant telescope. On the plus side, radio astronomy observations are not deterred by sunlight, clouds, or rain.

Over 70% of matter in the universe is hydrogen. Hydrogen atoms are the fuel for star formation and are key to detecting cosmic radio signals. Each hydrogen atom comprises a proton and electron, both of which have "spin" that can either be aligned or anti-aligned. If the spins are aligned, the atom has slightly more energy than if the spins are anti-aligned. When a hydrogen atom transitions from the aligned to anti-aligned state, it loses and emits radio energy at a wavelength of 21 cm. Conversely, when going the other way, it absorbs radio energy of the same wavelength.

Spanning thousands of kilometres and scattered across the globe, the square kilometre array (SKA) telescopes observe this 21 cm emission and absorption of radio energy. Australia's contribution is the Murchison Widefield Array (MWA) in Western Australia, located away from interference from phones and TV satellites. It looks across the entire Southern Hemisphere sky. Astronomers use it to hunt for intergalactic hydrogen gas that surrounded early galaxies as they formed by detecting and imaging the gas distribution in hundreds of thousands of galaxies.

> Virginia herself scours the universe for hydrogen flipping between spin states. She is working towards next generation radio surveys like SKA, in the hope that it can shed light on dark energy, uncover how the first stars and black holes were formed, and perhaps even discover life among the stars.

As you look at the night sky, think about the distant star-forming regions, black holes and supernova remnants sprinkled across the sky, invisible to our eyes.

Why Do We See Emerging Infectious Diseases?

By Dr Jane Canestra, MRSV

When a previously unrecognised infectious disease like COVID-19 appears, or a known infectious disease like Monkeypox infects people outside the region in which it usually occurs, or there is a surge in infections as happens with pandemic influenza, such illnesses are referred to as emerging infectious diseases.

Emerging infectious diseases recognised over the past few decades include Hepatitis C, Human Immunodeficiency Virus (HIV), Severe Acute Respiratory Syndrome (SARS), Ebola, Zika virus, variant Creutzfeldt-Jakob disease (also called mad cow disease), and many others. A much older 'emerging infectious disease' is Bubonic Plague which devastated populations at various times in history including under Emperor Justinian I, in 6th century CE, and as the black death of the Middle Ages.

> The emergence of such diseases causes sickness, death, and significant disruption to society. They are important, often at a global scale.

The majority of emerging infectious diseases are zoonoses, that is, the primary host organism is a non-human animal species. So why do these diseases cross over into human populations?

There are a number of contributing factors:

- Ecological, including change in land use, deforestation, and climate change
- Human behaviour such as urbanisation, outdoor activities, changed sexual behaviours, and recreational drug use
- International travel and commerce
- Technological, for example widespread antibiotic use, and changes in food processing
- Adaptation of disease-causing microorganisms; and
- Breakdown in public health measures such as poor sanitation, and reluctance to be vaccinated.

As it is worth considering each of these points in detail, they will be explored in a subsequent issue.

World Environment Day

By Priya Mohandoss MRSV

Each year on June 5th more than 100 United Nations (UN) countries join forces to commemorate World Environment Day, with a focus on the future of our planet Earth.

> This year we observe its 50th anniversary with the theme, "Only One Earth".

This theme was chosen to commemorate the slogan employed for the United Nations Conference on the Human Environment, also known as the Stockholm Conference, held from June 5th-16th 1972 in Stockholm, Swede – 50 years ago. This meeting was the first time that the UN acknowledged the environment as a key component in the future of global politics. It led to the establishment of the UN Environment Program (UNEP), the Stockholm Declaration and assigning of June 5th as World Environment Day.

5 June 1972 - United Nations Conference on the Human Environment, Stockholm, Sweden. Mrs. Indira Gandhi, Prime Minister of India, being greeted by Mr. Maurice F. Strong, Secretary General of the Conference, upon her arrival at the Conference. (Photo Credit: UN Photo/Yutaka Nagata)

In honour of this 50-year milestone, Sweden will host Stockholm +50 and be host country for World Environment Day in recognition of the nations' resolute stance on the environment in the intervening period. Accordingly, the attention will be on Sweden's proposals, principal environmental interests, and global targets to safeguard the Earth through achieving net zero emissions by the year 2045 and ensuring negative emissions thereafter

The UN General Assembly will be the major organiser of this event, to be held from the 2nd-3rd of June to implement a roadmap to recovery from the Covid-19 pandemic and endorse the workings of the 2030 agenda.

The theme for 2022 remains as relevant today as it was in 1972, calling for all to strive and find the balance we need to survive, since the Earth is still the sole planet where humans can survive.

Days such as this provide a vehicle for the UN to engage with concerns for nature on a global scale, with the intent to make a difference. It also allows a platform for everyone to seek the balance needed to successfully co-exist with our natural world.

REFERENCES:

The report of the United Nations Conference on the Human Environment

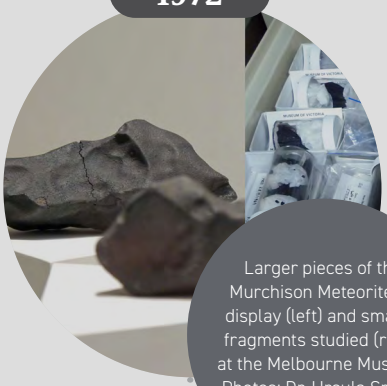
https://www.un.org/ga/search/view_doc.asp?symbol=A/CONF.48/14/REV.1

Agenda 2030

https://sdgs.un.org/sites/default/files/publications/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

FROM THE ARCHIVES

1972



Larger pieces of the Murchison Meteorite on display (left) and smaller fragments studied (right) at the Melbourne Museum. Photos: Dr. Ursula Smith/ Melbourne Museum

ANSWERS FROM ABOVE

A presentation on The Murchison Meteorite and Evolutionary Theory was made to the RSV on the 12th of October 1972, by the University of Melbourne School of Chemistry's Dr. R.B. Johns (1930-2013). The meteorite broke up in the atmosphere above the Victorian town of Murchison in 1969, and many studies have since been published on the organic molecules found inside - giving us insight into the extra-terrestrial presence of the chemical building blocks of life.

Learn more about the Murchison Meteorite at Museums Victoria: **www.museumsvictoria.com.au/article/the-murchison-meteorite/**

1922

Joseph Baldwin and colleagues erect a heliostat and telescope in preparation of the solar eclipse. Source: Museums Victoria.

SOLAR ECLIPSE AND GENERAL RELATIVITY

Multiple presentations were made to the RSV regarding the total solar eclipse that occurred on the 21st of September 1922, including a lecture from Mr. Charles J. Merfield on July 13th, and another from Dr. Joseph Baldwin on October 12th. It was planned to utilise the eclipse to repeat the Eddington experiment of 1919, in which the gravitational impact of the sun on starlight passing close to it could be observed, so as to confirm Einstein's recently published theory of general relativity.

The Melbourne Observatory Eclipse Party, led by the Victorian Government Astronomer Dr. Joseph Baldwin, travelled to Goondiwindi in Queensland, where they were joined by a group from the Sydney Observatory. As spectacular as the sight was, they were undermined by their equipment, and the photos taken proved insufficient for confirming Einstein's theory. Fortunately, another group who observed the eclipse from Wallal, WA, had more success.

1872

John King, back in Melbourne, c. 1861.

THE DEATH OF JOHN KING

At the age of 18, the Dublin-born John King joined the ill-fated expedition of Robert Burke and William Wills. King was only survivor of the four explorers (Burke, Wills, Charley Gray and King) who reached the Gulf of Carpentaria, following the deaths of Gray, Wills, and lastly Burke in June of 1861. He survived a further 2 months in the land near Innamincka, SA, thanks to the generosity and care of the local Yandruwandha people, whose Country covers a vast area in north-east South Australia.

John King was found by the Victorian Relief Expedition in September 1861, close to death from starvation, and returned to Melbourne. He was 20 years old. He never recovered from his experiences of the ill-fated expedition, and died from tuberculosis in January 1872, aged 30.

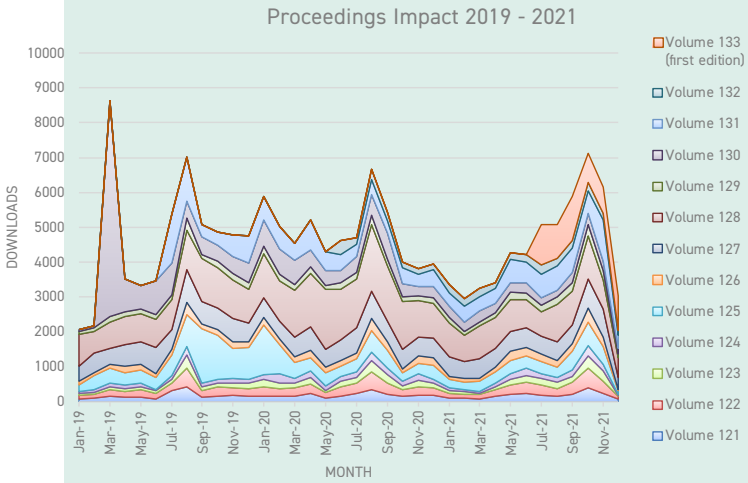
It later came to light that, while in the care of the Yandruwandha people, John King had fathered a child (known as 'Annie') with an Aboriginal woman. Descendants of King are counted among the Yandruwandha people today.

Learn more about John King and an Aboriginal perspective on the Burke and Wills Expedition, including an introduction from a descendant of Annie King, in "*The Aboriginal Story of Burke and Wills: Forgotten Narratives*", edited by Prof. Ian D. Clark and A/Prof. Fred Cahir (Published by CSIRO Publishing, ISBN: 9781486306275)

PROCEEDINGS

Journal Performance and Forthcoming Papers

The Society has recently reached agreement with CSIRO Publishing to extend our current contract for another year. It's likely that the next contract will see some changes in the way the journal is managed, mainly through the use of the ScholarOne system for submitting papers. It will be interesting to see if and how this change will affect the number of manuscripts we receive.



CSIRO has recently provided the Society with Altmetric data for the journal over the past six years, which make for interesting reading. Altmetrics provide a weighted count of all the mentions a particular paper receives, thereby indicating the size and extent of its reach. There are a number of 'standouts' in the data, in particular the papers from the German Symposium in 2015 (**volume 127**); the Eucalypt Symposium held in 2016 (**volume 128**); and the Moyjil papers on the possible early Indigenous settlement site near Warrnambool (**volume 130**). Perhaps not surprisingly, the paper with the greatest Altmetric value is on the Maryborough meteorite (**volume 131**). Data for **volume 133** (2021) are not yet complete, but the paper by David Pollock on the reintroduction of the dingo to pastoral country has attracted the most interest so far. It was one of six papers arising from the online symposium on Stewardship of Country, run under the auspices of the Royal Societies of Australia.

Interested members can see the Altmetric data for all papers at **http://www.publish.csiro.au/rs**.

Two papers are close to being finalised for the first issue of 2022 (Volume 134, part 1). One puts forward a novel theory on the link between the extinction of native animals following the cessation of Indigenous patch burning; the other is a transcription from the German of articles written by George Ulrich in 1859, describing the geology, mining methods and social attitudes at the height of the Victorian gold rushes.

A reminder to members that contributions to the Proceedings are greatly welcomed.

Dr Bill Birch AM
Editor-in-Chief
editor@rsv.org.au

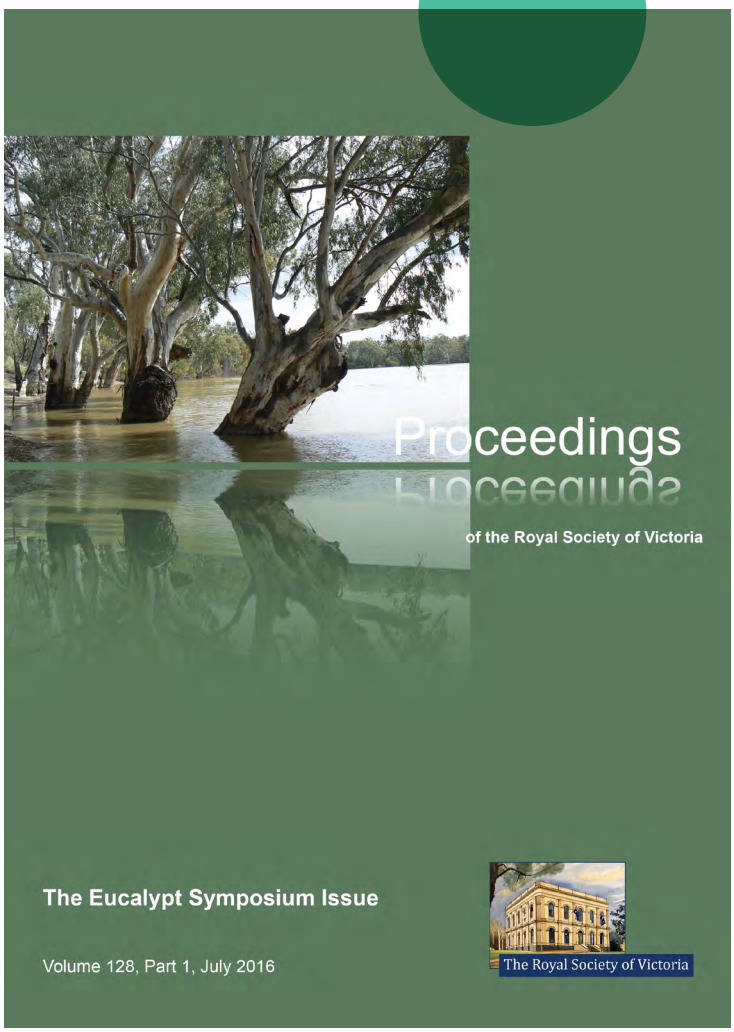
Call for Papers

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 http://www.publish.csiro.au/rs.

> 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. We are always interested in hearing from authors.

Papers, Reviews and Reports of experimental or descriptive research, submitted for publication by the Royal Society of Victoria, should not have been published hitherto, nor should they be under consideration for publication elsewhere. Published papers are typically concerned with natural history, encompassing the biological and earth sciences, in the Oceania region.

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



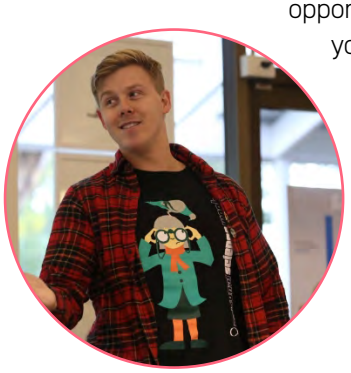
INSPIRING VICTORIA

Up and Atom! National Science Week is Fast Approaching

With winter setting in, National Science Week is Just around the corner. This August, get involved in shaping our bright, collective future by engaging with the world of science.

Each year, over one million people participate in more than 2000 events across the country. Victorian libraries bring the science from books on their shelves to life, schools celebrate with fanfare, and community groups get together to think about how science can improve their community and lives. These events attract a wide audience from children to adults, citizen scientists to professionals, encouraging a broader interest in scientific pursuits, and inspiring younger people to be curious and fascinated by the world we live in.

This celebration of science is your opportunity to contribute ideas, satisfy your curiosity, and learn about some of the many contributions by Australian scientists to the world of knowledge. The future is for everyone to create, and science is helping to build our future.

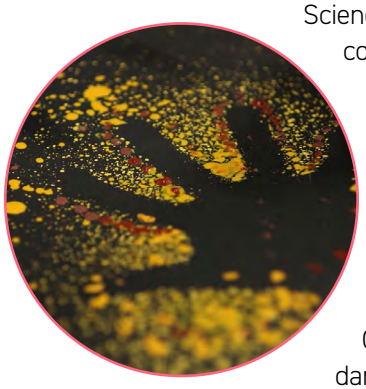


national science week
13 – 21 AUGUST 2022 – AUSTRALIA WIDE

Inspiring AUSTRALIA Victoria

We encourage everyone to think about how Science, Engineering, Technology and Mathematics (STEM) is relevant to our everyday lives. Perhaps you have an idea for an event to celebrate the wonders of STEM with your community. The **How to run a National Science Week event guide** is a useful tool to get you started. Host a talk, or run demonstrations, hands-on activities, workshops...the sky is the limit!

To help make your event more inclusive of people with disability, the National Science Week **Disability Inclusion Guide** provides pointers on delivering accessible events. To reach young minds, the **Early Childhood Activities** booklet features case studies of successful events as well as detailed instructions for activities suitable for very young scientists and explorers.



Science has always been, and continues to be, a part of everyday life for Aboriginal and Torres Strait Islander peoples, with scientific knowledge embedded into every aspect of understanding Country: the land, sky, and sea. Cultural stories, songs, art, dance, and traditions are all part of Indigenous Knowledge systems based on observation over tens of thousands of years. **This guide** can inspire you to run an event that celebrates our first scientists.

Be part of the action during Australia's largest science festival. Please **register your event** if you are planning to host one; otherwise, find out what is happening near you. With so much on offer, it's impossible to be bored during National Science Week. There are so many events to enlighten, enthral, and entertain.

In Victoria, the Royal Society of Victoria manages the National Science Week Victoria program with assistance from the Inspiring Victoria Partnership Board, in partnership with the Commonwealth Department of Industry, Science, Energy & Resources, and the Victorian Commissioner for Environmental Sustainability.

ENGAGE VICTORIA

Current Government Consultations of Interest to Victoria's Science Community

Broken River System Review

The community is now invited to provide feedback on the draft Broken Review Summary Report to inform final recommendations on its future management.

Consultation closes 29 June.
https://engage.vic.gov.au/broken-review

Port Phillip Bay and Bellarine Peninsula Ramsar Site Boundary Review

Help us identify potential additions to the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site.

Consultation closes 10 June.
https://engage.vic.gov.au/port-phillip-bay-and-bellarine-peninsula-ramsar-site-boundary-review

Victoria's Offshore Wind Policy Directions Paper

Have your say on the Offshore Wind Policy Directions Paper and contribute to Victoria's energy future.

Consultation closes 30 June.
https://engage.vic.gov.au/victorias-offshore-wind-policy-directions-paper-developing-the-offshore-wind-sector

Voltage Management in Distribution Networks Consultation Paper

Have your say about the opportunities and challenges associated with voltage in Victoria's distributed energy network for community,

Consultation closes 1 August.
https://engage.vic.gov.au/voltage-management-in-distribution-networks-consultation-paper

RSV Services and Facilities

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!

We provide services in **event management**, meeting **venues**, grants and awards **administration**, broadcasting and video **production**, social media c**ampaign management**, **recruitment** of scientific panels, and **convening** community engagement and deliberation processes where scientific work contributes to social, environmental, and economic impacts and benefits.

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.

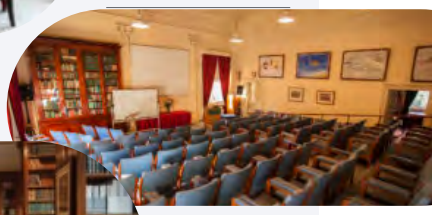
For more information and bookings please contact our Business Manager at **james@rsv.org.au** or on +61 3 9663 5259

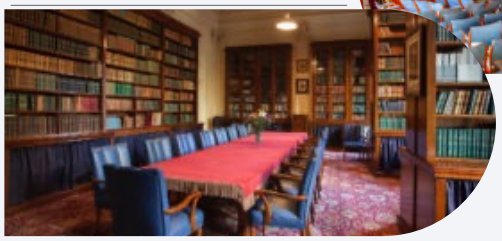
SERVICES AVAILABLE

The Burke and Wills Room
Multi-functional space with adjoining kitchen, suitable for: Workshops ‹*30 people; Dinners ‹60 people; Seminars, functions, catering, etc., ‹80 people.*

The Von Mueller Room
Seminar room for ‹*15 people.*

The Ellery Lecture Theatre
Raked seating for ‹*110 people.*





The Cudmore Library
Capacity for ‹*24 people*

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.

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 https://rsv.org.au/support-the-rsv/

RSV 2020 FUNDRAISING CAMPAIGN AMOUNT	*AMOUNT*
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	$
TOTAL	**$**

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☐ **Cheque or Money Order**

I enclose my cheque or money order made out to **The Royal Society of Victoria**.

Electronic Funds Transfer (EFT)

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BSB: 083-019
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Account Name: The Royal Society of Victoria
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The Royal Society of Victoria