



The Royal Society OF VICTORIA

Promoting science since 1854

PATRON: The Hon Linda Dessau AC
Governor of Victoria

PRESIDENT: Mr David Zerman

This Month's Events...

12th September: Let's Torque Grand Final

A science communication competition featuring eight short, sharp talks on a range of engaging science topics.

13th September: Dr Andrew Weeks

"Genetic Rescue: Thinking Small to Save Threatened Species"

14th September: Dr Gillian Sparkes

Joint Lecture with the Australian Meteorological & Oceanographic Society

"Delivering the 2018 Victorian State of the Environment Report"

27th September: Dr Sumeet Walia and Dr Nishar Hameed

Joint Winners of the 2018 Phillip Law Postdoctoral Award for the Physical Sciences

"Faster, Lighter, Smarter"

October Advance Notice

11th October: Professor Susan Blackmore

Joint Lecture with the Australian Skeptics (Victorian Division)

"Memes & Tremes: From Biology to the Future of Artificial Intelligence"

25th October: Dr Drew Berry

Annual RSV Science Communication Lecture

"Molecular Machines: Creating Flesh & Blood"

September 2018 Newsletter

Print Post Approved 100009741

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rsv.org.au



Let's Torque Grand Final

Wednesday, 12th September 2018 at 6:00pm



The Let's Torque Grand Final returns to the Royal Society of Victoria for another night of top quality presentations by the next generation of STEM communicators. Come along to learn from our finalists about some of the most exciting STEM solutions and mingle with members of the STEM communication community!

The grand finalists are:

- **Natalia Zivcic** - *Brain-Computer interfacing: Magic or Science?*
- **Sabna Zihara** - *MOFTA – Metal Organic Framework as Theranostic Agents*
- **Emma Crooks** - *MDMA: A Solution for Extreme Trauma*
- **Jacqui Wakefield** - *The Hero of the Reef: Unmasking the Vigilante*
- **Eric Tian** - *Stem Cells to Revolutionise Meat*
- **George Loram** - *Mental Illness & Sleep*
- **Jun-Ting Yeung** - *Lessons from the Frog Prince*
- **Tara Jadwani-Bungar** - *Phages – Making (Antibiotic) Resistance Futile*



The event will kick off with some drinks and delicious canapés, followed by a keynote speech from **Dr Chris Thompson**, Science Communicator and Associate Dean of Education (Faculty of Science) at Monash University.

Our judges are **Dr Amanda Caples** – Victoria's Lead Scientist, **Sarah Moran** - co-founder and CEO of Girl Geek Academy, and **Sophia Varelas** - Partner at PwC Australia.

Places limited, bookings essential! Register online now at <https://rsv.org.au/events/lets-torque/>, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au . \$15 a ticket in support of undergraduate science communication.



Genetic Rescue: Thinking Small to Save Threatened Species

Thursday, 13th September 2018 at 7:00pm



Speaker: Dr Andrew Weeks

Ecological Geneticist & Director, **cesar**

You may have heard of threatened species rescue, but did you know that genes often need rescuing too?

When problems like feral predators, food source availability, and habitat loss have been resolved, some threatened species still flounder due to a limited diversity of genes within their gene pool. In these cases, an injection of new DNA into the population can give threatened species that extra fitness boost needed to thrive. This is called 'genetic rescue' – a conservation strategy that provides a way for inbred populations to restore lost genetic variation, but has rarely been used in threatened species recovery programs – until now.

About the Speaker:



Dr Andrew Weeks is a Director and ecological geneticist with biodiversity conservation and agricultural management organisation **cesar**. He applies his knowledge of population genetics to projects concerned with the conservation of Australian wildlife. Andrew actively participates in several threatened species recovery teams in Australia, where he advises on genetic issues, as well as developing research programs that look at mixing genetically differentiated populations as a way of improving the fitness and genetic variation in populations that

have undergone large declines.

In 2010, Andrew led a research team that implemented the first Australian genetic rescue in the endangered Mt Buller mountain pygmy possum, completely reversing a population collapse and preventing its imminent extinction. In July 2018, Andrew and his collaborators have been nominated for the prestigious **Australian Museum Eureka Prize** for this genetic rescue mission. **cesar** and project partners are now focusing on using the same approach for another threatened Australian marsupial, the Victorian eastern barred bandicoot at the **Mt Rothwell Conservation & Research Centre**.



Places limited, bookings essential! Pre-lecture function from 6:00pm. **Register online** now at <https://rsv.org.au/events/genetic-rescue/>, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au

Delivering the Victorian State of the Environment Report

Friday, 14th September 2018 at 7:00pm

Speaker: Dr Gillian Sparkes

Commissioner for Environmental Sustainability, Victorian Government

A joint presentation between the RSV and the **Australian Meteorological and Oceanographic Society**.



Australian Meteorological
& Oceanographic Society

Victoria's forthcoming 2018 State of the Environment report will answer critical questions about Victoria's natural environment. What has changed in five years? How does Victoria's air and water quality measure up? What is the condition of our state's unique flora and fauna? How healthy are our soils and waterways? How do we transition to a contemporary waste management and resource recovery system? What are the trends and future projections for Victoria's changing climate?

For the first time, the Commissioner has released an interim report to help frame and guide the delivery of this crucial five yearly report. This talk provides an opportunity for the Victorian public to hear **Dr Gillian Sparkes** present on the [Interim SoE 2018 report](#) and our progress towards answering those important questions in the final **Victorian State of the Environment Report 2018** – the key policy and management issues, and the data and information challenges, for each of the twelve themes: air quality, climate, biodiversity, land health, forests, fire, water resources, water quality, coastal and marine environments, waste and resource recovery, energy and transport. Dr Sparkes will also address the emerging opportunity to adopt the United Nations' **Sustainable Development Goals** as a framework for monitoring Victoria's progress against critical environmental targets over the next decade, out to **2030**.



About the speaker:



Dr Gillian Sparkes has been **Victoria's Commissioner for Environmental Sustainability** since 2014, appointed to the role by both sides of government. Since refreshing the science reporting function of the Office, the Commissioner has been assigned six new, independent reporting functions since 2015, for the first time since the role was established in 2003.

Dr Gillian Sparkes spent the first half of her career with BHP and achieved a PhD in chemistry before taking leadership roles in operations and environmental management with BHP. She has since held executive and board roles across the industrial, public and university sectors, including as CEO of a Monash research centre for waste and resource recovery, non-executive director of South Gippsland Water, Deputy Secretary Victorian Department of Sustainability and Environment and Chair of the Board of Sustainability Victoria. As Commissioner, Dr Sparkes is an advocate for increased investment in environmental monitoring, community participation in environmental science and for government to better apply environmental economic accounting, data analytics and citizen science to protecting the environment and dealing with the challenges of population growth and climate change.

Dr Sparkes has a PhD in Applied Science, an MBA, is an AICD Fellow, a Victorian Fellow of IPAA, MEIANZ and MRACI. She is a member of the Victorian (DEDJTR) Investment Committee, Chair of the Western Port Integrated Water Management Forum and is a company director with a board portfolio across the economic, emergency management and NFP sectors.

Eventbrite

Places limited, bookings essential! Pre-lecture function from 6:00pm. **Register online** now at <https://rsv.org.au/events/state-of-the-environment/>, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au

Campfires & Science at Plenty Gorge

Saturday, 15th September 2018 from 6:00pm



Love camping? Love science? Get involved!

Campfires and Science is a new and growing community of people who head outdoors, light a campfire, and share knowledge. We lead regular, free events in wild places to support scientific fieldwork and provide hands-on training in the research methods that help us to best protect the environment. Welcome to citizen science!

This special event at Plenty Gorge, hosted by the new **Banyule-Nillumbik** and **Whittlesea Tech Schools**, will feature experts talking about how to monitor wildlife numbers using a range of methods, including collecting DNA samples from the environment that can tell us the range of animals that live there (eDNA). We'll also be hearing about their work and sharing the special knowledge they've attained through years of study and exploration.

Join us around the campfire at this free event to share knowledge and a meal. Bring your family and friends for a great afternoon and evening in one of Melbourne's wild places!

BANYULE-NILLUMBIK
TECH
SCHOOL

WHITTLESEA
TECH
SCHOOL



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Eventbrite

Places limited, bookings essential! Register online now at <https://rsv.org.au/events/plenty-gorge/>, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au

Global Citizen Science: Can Citizens Deliver and Make a Difference?

Monday, 17th August 2018 from 2:00pm



Speaker: **Martin Brocklehurst**

Chair, European Citizen Science Association Policy Working Group
Coordinator, CSGP Delegation to the 2018 UN World Data Forum

We are witnessing an explosion of Citizen Science activity as technology makes it possible for citizens to take part in science and deliver unprecedented levels of quality data across the globe.

With support from UNEP and the Wilson Centre in the US, the **Citizen Science Global Partnership** (CSGP) was agreed at the UN Environment Assembly (UNEA3) in Nairobi 2017. Citizen Science Associations have emerged in Australia, Europe the USA and Asia and discussions are underway to set up Associations in Africa and South America. CSGP is planning sessions on Citizen Science in Dubai at the Eye-on-Earth Symposium in October 2018 that will take part in parallel with the UN World Data Forum as the value of unconventional data sources is increasingly recognised by National Government. CSGP will also be present in Nairobi at UNEA4 in March 2019 at the highest-level environmental decision making body on the planet.

Martin Brocklehurst has been at the forefront of activity to bring the global citizen science community together to develop global programmes that have the potential to provide data and information that can be used to:

- Empower citizens to manage emerging risks to their health and wellbeing;
- To provide information to Governments that can be used to justify policy shifts to deal with emerging global problems such as poor urban air quality and invasive species that bring new diseases and disrupt existing ecosystems;
- Track progress against the UN Sustainable Development Goals; and
- Provide health professionals with levels of detail on disease and disease vector carrying species, at a speed and accuracy that will enable scarce resources to be targeted with a precision not possible using conventional scientific approaches.

This talk and the associated discussions will explore whether we are ready to take the next step as Global Citizen Scientists and develop the integrated programmes that will prove the value of CS at the global level. Successful programmes are needed to drive change and encourage Governments to actively engage across the planet with the Citizen Science Community. It will also explore the leading role that Australia could play in that process as

September Events at the Royal Society of Victoria

the lessons learnt in running Citizen Science Programmes on the Australian Continent are shared with the global community.

About the Speaker:



Martin Brocklehurst is the Chair of the European Citizen Science Association Policy Working Group and Coordinator of the CSGP Delegation to the UN World Data Forum in Dubai in October 2018. He is visiting Australia in September to meet with policy-makers, share his experience and discuss all aspects of utilizing Citizen Science to achieve policy outcomes.

Martin is a founding instigator of the **European Citizen Science Association (ECSA)** and the **Global Mosquito Alert Consortium**. He is Chair of the ECSA Policy Working Group and has significantly raised the profile of Citizen Science and its potential value to governments and global institutions, working with UNEP and Citizen Science Associations around the world. Martin is an acknowledged leader of the Citizen Science movement and has developed working relationships at the highest level globally to promote the value of Citizen Science and the data it can deliver to the UN Agenda **2030 Sustainable Development Goals**.

Martin is also a national expert on **Waste and Resource Management** and the UK National Representative on the ISO and CEN/CENELEC Ad Hoc Groups to explore what additional standards are needed to promote the Circular Economy and previously he was the Technical Advisor to the Parliamentary Environment Audit Select Committee, "Growing a Circular Economy: Ending the throwaway society" as well as adviser to the International Solid Waste Association (ISWA) on the same topic.

Martin has taken on environmental advisory roles for a wide range of organisations including NGO's, Public Sector Regulators, Trade Bodies and the UK Parliamentary Audit Committee. For 13 years, he was a senior public-sector regulator, in developing and delivering UK Environmental Regulations, pioneering new approaches to regulation. For 14 years, he was a senior health safety and environmental manager in business recognised for delivering outstanding performance for multi-national oil companies. Independent Environmental Consultants (2011-18), Executive Manager UK Environment Agency (1998-2011), Senior HSE Manager Gulf Oil, Chevron and BP (1984-1998).

Martin's specific interests in Citizen Science and the SDG's relate to:

- Invasive species and in particular tree diseases;
- CS Global Mosquito Alert and linked CS health monitoring;
- CS Air Quality monitoring and linked CS health monitoring;
- CS projects on Resource Efficiency and the Circular economy;
- CS projects relating to litter monitoring on land and programmes to reduce plastic litter into the marine environment from land; and
- CS in supporting programmes to understand and reduce the decline in natural ecosystems.

Presented by the Victorian Chapter of the **Australian Citizen Science Association** in partnership with the **Arthur Rylah Institute for Environmental Research**, the **Royal Society of Victoria**, the **United Nations Association of Australia Victorian Division**, the **European Citizen Science Association** and the **Citizen Science Global Partnership**.



Eventbrite

Places limited, bookings essential! A networking function follows presentations and formal discussion. **Register online** now at <https://rsv.org.au/events/global-citizen-science/>, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au

Empowering Connections in STEMM

Wednesday, 26th September 2018 at 5:00pm



Women in STEMM Australia is hosting a special event to connect **high school students, teachers and parents** with PhD students and professionals in science, technology, engineering, math and medicine (STEMM)! There will be the chance to ask questions about studying these fields, going to University, the future career opportunities, and more!

Our guest speaker, Ms Kristine Hendry, is Senior Executive Officer of the Spinal Research Institute (SRI), a not-for-profit dedicated to supporting world-class clinical research and clinical trials in the field of spinal cord injury. Kristine will share the vision of the SRI and the work they do, as well as her career path within the computer science and technology sector.

STEMM Entrepreneur and Women in STEMM Australia Co-founder, Michelle Gallaher, will then lead a fascinating discussion with five professionals at different career stages in academia and industry, about the key decision-making times in their lives, what influenced their choices, and how to foster a much-needed culture shift toward greater diversity and inclusion, and how to maximise opportunities to pursue STEMM education and careers, and ensure more women in STEMM reach senior-level roles. How do we train AND retain these talented professionals?

Gain valuable insight into how we can all better support our students, especially girls in STEMM, and accelerate their education and careers, and foster an environment where more women in STEMM can lead and excel!



Guest Speaker:

Kristine Hendry, Senior Executive Officer, Spinal Research Institute. Kristine has a background in computer science and technology services.



Facilitator:

Michelle Gallaher, Co-founder and Creative Director, Women in STEMM Australia and Director, The Social Science

Panellists:



Dr Elaine Saunders is an industry leader and Executive Chairman of Blamey Saunders hears. She is also an Allied Digital Health Champion, Non-Executive Director and Women in Leadership Awardee with BioMelbourne Network. Elaine heads a company that develops state-of-the-art hearing aids in collaboration with academia.



Amy Searle is a Kamilaroi biomedical researcher and PhD student at the Baker Heart and Diabetes Institute. Amy's research has the potential to impact the mortality associated with cardiovascular diseases like heart attack and stroke.



Dr Prajakta Bhagwat is a Chemical Engineer and Project Manager at Sequirus, CSL which is a pharmaceutical world leading company producing pandemic flu-vaccine, antivenins, antitoxins, and immunohematology products.



Marnie Graco is a physiotherapist and PhD student. The focus of Marnie's PhD is to improve the management of sleep disorders for people living with spinal cord injury.



Dr Madhu Bhaskaran is an Electronic Materials Engineer, Associate Professor and Co-Group Leader in Functional Materials and Microsystems Research. Madhu develops wearable tech and collaborates with industry. Madhu is also a Director on the Board of Women in STEMM Australia.

Following the panel there will be the opportunity to connect and ask questions over a bite to eat. This is a relaxed, friendly event and we encourage all students to readily engage and ask loads of questions. Bonus gifts at this event include a Women in STEM poster from the STELR team at ATSE and a Careers in STEM magazine from Refraction Media. You can collect these at the registration desk.



Your Women in STEMM Australia host:

Dr Marguerite Evans-Galea, Executive Director, Industry Mentoring Network in STEM, Australian Academy of Technology and Engineering; Co-founder and CEO, Women in STEMM Australia

Who should attend: Everyone! Including industry and university leaders, STEMM professionals, researchers, policy-makers, school principals, teachers, career counsellors, students, parents, girls and women interested in STEMM. All welcome!

THANK YOU: This event is in partnership with the Rotary Club of Brunswick-Tullamarine and the Royal Society of Victoria. Proceeds of this event go to the Spinal Research Institute, which is committed to improving the lives of people with spinal cord injuries. Thanks to all for their open collaboration!!



Rotary



Club of Brunswick
Tullamarine



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Eventbrite

Places limited, bookings essential! Register online now at <https://rsv.org.au/events/empowering-connections/>, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au

Faster, Lighter, Smarter

Thursday, 27th September 2018 at 7:00pm

The 2018 Phillip Law Postdoctoral Award Presentation Lecture

Speakers: Dr Nishar Hameed

Group Leader of Smart Polymers & Composites Research Group
Swinburne University of Technology

Dr Sumeet Walia

Vice-Chancellor's Research Fellow & Senior Lecturer, School of Engineering
RMIT University

Research and application in the field of materials science has never moved at such an incredible speed. Working in scale from the human to the nano, our engineers are making remarkable progress, applying new knowledge to fields of electronics, healthcare, transport and many others through advanced manufacturing techniques.

Come discover the bleeding edge of materials science with this year's **two** winners of the **Phillip Law Postdoctoral Prize for the Physical Sciences!**



Dr Sumeet Walia: Materials Engineering for Electronics & Healthcare

Sumeet's work is based on unlocking novel properties in ultra-thin materials and deploying them to demonstrate fascinating next-generation applications in electronics and healthcare. He is developing future semiconducting materials for electronics, chips that can mimic the human brain for storing and recalling past information, smart sensors for health monitoring and miniaturised energy sources. His research relies on multidisciplinary innovation to create functional application-oriented, futuristic platforms for implementation across the breadth of technology.



Dr Nishar Hameed: Manufacturing Materials of the Future

In the transport sector, two global trends are becoming increasingly important – lightweight and smart functions. Future cars need to be smart enough to be connected, safe and strong enough to withstand catastrophic collisions, light enough to move effectively and efficient enough to minimise fuel consumption for low carbon emissions. This is set to become a reality, with cars made of lighter but stronger carbon fibre composites where thin fibres, 10-times smaller than the width of our hair, are glued together. Stronger than steel and lighter than aluminium, carbon fibres are essential materials for the future of low-cost, sustainable mass transport. More than 50% of current generation aeroplanes are made from carbon fibre composites. These composites have the potential to reduce the weight of current passenger cars by up to 45%. The lighter the car, the less fuel required to move it, and the fewer emissions created – meaning we can all fight climate change while driving a safer car. Making these composite structures “smart” can inform you about ongoing damage and critical maintenance requirements for your vehicle. Nishar's recent Australian breakthrough research on rapid manufacturing of smart and lightweight composites have the potential to revolutionise the way we make these materials and lead next generation composite technologies.



Places limited, bookings essential! Pre-lecture function from 6:00pm. **Register online** now at <https://rsv.org.au/events/faster-lighter-smarter/>, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au

Nominations for RSV Membership

Nominations for membership of the Society have been received on behalf of:

Mr Robert **GLAVICH**, Student & Housing Worker
Dr Faith **KWA**, Laboratory Medicine Lecturer,
RMIT University

A/Professor Paul Allen **RAMSLAND**, Principal
Research Fellow, RMIT University

A/Professor Andrew **PASK**, ARC Future Fellow,
The University of Melbourne

Mr John Wagner **GRAVES**, Retired

Miss Nhi **TRAN**, PhD Student, RMIT University

A/Professor Kerrie Esme **DOYLE**, Indigenous
Health, RMIT University

Unless Members request a ballot, these will be considered for election by Council and if elected, will be announced at the Ordinary Meeting of the Royal Society of Victoria to be held on 11th October 2018. Recently elected members who have not yet signed the Society's membership book are warmly invited to attend the 13th September meeting to be formally welcomed as members. **Please inform the office if you plan to attend, so we can prepare your membership certificate for collection.**

A number of established members have indicated they have never had an occasion to 'sign in' – again, **please let us know at the office** if you'd like to rectify the situation, and we'll make sure you get the opportunity!

The Young Scientist Research Prizes – 2018 Competition Results



Four categories of science, eight amazing presentations! What a wonderful night we had at the Society, with these outstanding early-career scientists presenting their remarkable work with passion, humour and poignancy. Drawn from a very competitive applicant pool of 47 final year PhDs from across Victorian research institutions, these newest members of the Royal Society of Victoria were already assured of a prize on the night – it was just a matter of which one.

On being shortlisted to present, the final task before them was to communicate the methods and significance of their complex work to a general audience of scientists and science enthusiasts in a clear, concise and engaging presentation of no more than 10 minutes. This is a tough ask of a young researcher who has been living with the intense and all-encompassing experience of doctoral studies for many years. Ten short minutes to present three to four years of intense scientific inquiry to a general audience, while remaining true to the science, takes many hours of careful thought and diligent preparation, and all of our finalists demonstrated just how much they'd invested in transmitting their research effectively to the "interested yet uninitiated!" We convey our sincere thanks to all for their commendable efforts, particularly as many face the challenging final months of their doctoral studies.



Ultimately, our competition must acknowledge those who draw ahead of the pack on the grounds of effective communication, robust science, capacity to answer questions through audience discussion and the significance of their research. The results are listed below in each category, with warm congratulations to all our winners and runners-up.

Earth Sciences:

Winner: Anindita Samsu, School of Earth, Atmosphere, & Environment, Monash University



Anindita Samsu with RSV President David Zerman

Runner Up: Sonya Fiddes, School of Earth Science, The University of Melbourne



Sonya Fiddes with RSV President David Zerman

Physical Sciences:

Winner: Victoria Coyle, School of Science, Engineering & Health, RMIT University



Victoria Coyle with RSV President David Zerman

Runner Up: Radhika De Silva, Department of Civil Engineering, Monash University



Radhika De Silva with RSV President David Zerman

Biological (non-human) Sciences:

Winner: Axel Newton, School of BioSciences, The University of Melbourne



Axel Newton with RSV President David Zerman

Runner Up: Hayley Cameron, School of Biological Sciences, Monash University



Hayley Cameron with RSV President David Zerman

Biomedical & Health Sciences:

Winner: Aidan Kashyap, The Ritchie Centre, Department of Obstetrics and Gynaecology & Hudson Institute of Medical Research, Monash University



Aidan Kashyap with RSV President David Zerman

Runner Up: John-Paul Fuller-Jackson,
Biomedicine Discovery Institute, Monash
University



**John-Paul Fuller-Jackson with RSV President
David Zerman**

Congratulations once again to all our wonderful finalists, and for the many friends, family members, peers and PhD supervisors who attended in support. It was a wonderful night exploring a small yet vigorous sample of the remarkable work undertaken by the latest generation of Victoria's scientists across the disciplines, and a great way to celebrate National Science Week!

Thanks also to our hard-working assessors and judges over the course of this year's competition; Dr Jonathan McQualter, Dr Faith Kwa, Dr Samantha Richardson, Professor David Walker, Dr Kevin Orrman-Rossiter, Dr Catherine de Burgh-Day, Viktor Perunicic, Dr Tom Beer, Dr Bill Birch, Dr Julie Boyce, Dr Madeleine Willcock, Dr Tom Darragh, A/Professor Robert Day, A/Professor Gavin Smith and Dr Eric Trembl.

Young Scientists: The Presentations

By Catriona Nguyen-Robertson



Eight finalists presented their doctoral studies to compete for the one of four Royal Society of

Victoria prizes that foster and recognise excellence in Victoria's early career scientists. Covering a range of categories: Biomedical & Health Sciences, Biological Sciences (non-human), Earth Sciences, and Physical Sciences, the audience were enthralled with the young scientists' research.

**Axel Newton, School of Biosciences,
University of Melbourne**

***"Investigating the mechanisms that
contribute to convergent skull evolution."***



Axel Newton presenting to the Society

Convergent evolution occurs when animals that share similar environments or ways of life develop similar features, despite being distantly related. Axel is investigating how various physical traits that are shared between distant species are generated at the genetic level. His main focus is a comparison of the extinct thylacine, a marsupial, to canids, such as wolves. The two last shared a common ancestor 160 million years ago, but are both large predators that came to look so similar that they were sometimes mistaken for one another. While the thylacine is extinct, there are specimens around the world in museum collections that he can study to trace the development of the animal and visualise their morphology.

He compared the skulls of 113 different mammals, to definitively show that the thylacine skull is more similar in structure to those of canids than other marsupials. After investigating physical similarities, he compared the genomes of thylacines and wolves to other vertebrates, and found that there were common similarities between the regulatory regions of the thylacine and wolf genomes. These are sections of the genome that regulate when other genes are turned on and off. To date, he has approximately 300 candidate convergent regions, which are

undergoing accelerated evolution to result in the two animals developing similar physical traits to suit their shared way of life.

In order to determine the roles of these genes, he added individual candidate thylacine genes into mouse embryos and monitored when the genes were being activated during embryo development. He found that these thylacine genes tended to be switched on during the facial development of the mouse, therefore being consistent with thylacine and canids have similar skull structure. This is the first time genes from a thylacine have been expressed in a living animal since its extinction, and this work also represents a significant advancement in determining how DNA drives differences in form.

Radhika De Silva, Department of Civil Engineering, Monash University

“A 3rd generation disruptive technology for mining.”



Radhika De Silva presenting to the Society

Global energy and material consumption are expected to rise in exponential proportions during the next few decades, generating huge demands for deep earth energy (oil/gas) recovery and mineral processing. Conventional mining uses 10% of all energy consumed in Australia and therefore other methods of mining have to be devised to meet our increasing demands for resources. SCDA (Soundless Chemical Demolition Agents) offers a more environmentally-friendly alternative that involves running a solution of calcium oxide over rocks to fragment them and recovering the oils and minerals within. The drawback of this technique, however, is that it becomes inert in the presence of water – a major hindrance given the prevalence of water beneath the Earth’s surface.

Radhika has modified SCDA technology such that the calcium oxide becomes hydrophobic (water-resistant) and retains its fluidity in the presence of water. He also adds calcium chloride to accelerate the reaction, as the manipulation of calcium oxide to make it hydrophobic slows down its ability to fragment rock. He therefore proposes a method of injecting the solution into rock in multiple stages to fracture rock under high confining pressure in order to draw out minerals without having to excavate large quantities of rock (which would then go to waste), for a more sustainable method of mining.

Victoria Coyle, Centre for Advanced Materials and Industrial Chemistry, RMIT University

“Nickel–gold bimetallic monolayer colloidal crystals fabricated via galvanic replacement as a highly sensitive electrochemical glucose sensor.”



Victoria Coyle presenting to the Society

For diabetics, blood glucose monitoring is a daily chore for survival – and diabetics often test their blood levels more than once per day. It is typically performed by piercing the skin to draw blood, from which blood glucose concentration can be measured. With a combination of materials science, electrochemistry, and nanotechnology, Victoria is devising a non-invasive blood glucose sensor that measures glucose levels in the sweat instead of blood.

She coats a plain titanium substrate with nickel balls and dusts them with gold nanoparticles – creating “nano Ferrero Rochers”. Both nickel and gold are independently important in the development of highly sensitive electrochemical glucose sensors – sensors that detect the chemical process of electrons being transferred between molecules. Nickel and gold can react with glucose to cause electron transfer, and this reaction can be used to detect glucose levels.

The use of gold additionally reduces interference from physiological contaminants, ensuring that measurements are glucose-specific and not compounded by other sugars. Victoria tested the ability of nickel and gold to detect glucose levels and found that the combination of the two works best. She also tested the sensitivity, specificity, and reaction time of her nanoparticle sensor and found that it is comparable, if not better than other detectors. She therefore is on the way to developing a wearable glucose monitor for diabetes management, and it may also prove highly efficient for other chemical sensing applications.

Anindita Samsu, School of Earth, Atmosphere and Environment, Monash University

“Do fractures have ancestors?”



Anindita Samsu presenting to the Society

Fractures of different sizes and shapes are scattered across the Earth – whether they be surface ruptures caused by earthquakes that span several meters, or cracks in rocks that are only a few centimeters long. The Earth’s crust is divided into a mosaic pattern of tectonic plates that is constantly (albeit incrementally) moving and stretching, and the continents as we know them are merely a temporary arrangement of the Earth’s landmasses. Anindita is piecing the past and present together, reconstructing past movements of the Earth’s crust and past configurations of the tectonic plates.

As Australia drifts further away from Antarctica, the Earth’s crust is stretched and fractures form beneath (and on) the surface. It was previously assumed that the stretching direction was always perpendicular to fracture lines in the rocks of the Earth, however, modelling the Earth’s crust in a sandbox, Anindita disproved this theory in favour of another: if there is a line of weakness, no

matter which direction force is applied, the break will occur along the line of weakness (much like a Kit-Kat will generally split along the middle). She is exploring the “ancestry” of fractures in the Earth’s crust. Fractures at the surface (cover fractures) tend to inherit the characteristics of older basement fractures deeper down in the crust, as the crust is weaker along these lines. Examining exposed basement and cover fractures in the Gippsland Basin, Anindita has aligned them and mapped the fractures created over the past 160 million years as Australia drifted northwards, and her knowledge can be applied to rift basins and fractures around the world.

Sonya Fiddes, School of Earth Sciences, University of Melbourne

“The impact of coral reefs on climate.”



Sonya Fiddes presenting to the Society

We are conscious of the effect of climate change on coral reefs, especially with the damage of two mass coral bleaching events to the Great Barrier Reef in the past few years, however not many of us ask the question that Sonya is: what effect do corals have on climate?

Marine organisms, such as algae, corals, phytoplankton, and seaweed, produce dimethyl sulphide (DMS), forming the basis of the CLAW Hypothesis. This hypothesis proposes a negative feedback loop between ocean ecosystems and the Earth’s climate: that when phytoplankton are stressed due to heat leading to overgrowth, they release DMS, which becomes sulphur dioxide in the atmosphere as a precursor gas to aerosol formation. With a greater concentration of aerosols in the atmosphere, sunlight is physically blocked from reaching the Earth’s surface and clouds become more condensed to promote rainfall. This negative feedback loop thus cools oceans to reduce phytoplankton stress. Sonya is investigating whether this hypothesis holds true

for corals, by simulating a world with coral reef-derived DMS and a world without, and comparing their climates over a 10-year period. Her work may reveal that if we lose the Great Barrier Reef and other coral systems, there may be further implications than we currently realise.

Hayley Cameron, Centre for Geometric Biology, Monash University

“The eco-evolutionary dynamics of maternal investment.”



Hayley Cameron presenting to the Society

Across the animal kingdom, maternal care – the way mothers care for their young – is a continuum. From those mothers who lay eggs and disappear into the wild, to human mothers who care for their children for 18 years (and often much longer), it is clear that the initial maternal investment is important for all animals. It is established that larger offspring outcompete smaller offspring in terms of their growth, survival and reproduction. It therefore would seem plausible that any mother would have the largest offspring possible, however, due to the limited resources a mother may have at her disposal, there is a trade-off between size and number of children that she can have as any resources she has would have to be shared among siblings.

Hayley studies *Bugula neritina*, a sessile marine animal that appears similar to seaweed and coral, as a model of families to investigate sibling competition. She found that larger offspring tend to perform better than smaller offspring only in low sibling densities, and that with a greater number of siblings, it can often be the other way around. She also discovered that despite the number of siblings, the families with children of the most variable size tend to do best as a family, given that different-sized offspring help each other to perform better. Her work demonstrates that sibling interactions influence maternal

provisioning of resources for their young, and sheds light into the eco-evolutionary dynamics of maternal investment and sibling relationships.

John-Paul Fuller-Jackson, Department of Physiology, Monash University

“The metabolic significance of brown adipose tissue in sheep and humans.”



John-Paul Fuller-Jackson presenting to the Society

Weight-loss is not a physiologically easy process – not only because it involves dieting and exercise, but also because the body is programmed to maintain its weight. Individuals who lose a lot of weight quickly can struggle to keep it off. Animals have both white fat (the fat that we tend to associate with health, used for storage of energy) and brown fat, which mediates thermogenesis (generation of heat). Thermogenesis can be induced when we feel cold or when we eat food. The extent to which thermogenesis in brown fat occurs influences weight loss and metabolism as it is an active process (that burns calories without you trying), and weight loss can be thwarted when this process stops due to *metabolic slowing*.

While most obesity studies have been conducted in male mice, their brown fat thermogenesis isn't physiological comparable to that of humans. To overcome this, John-Paul monitored obesity in sheep and humans. He found that the combination of dieting and exercising, but neither alone, reversed metabolic slowing, allowing sheep to lose weight. Monitoring both male and female humans, revealed differences between men and women in meal-induced thermogenesis, and fluctuations in brown fat heat-generation with the menstrual cycle, and that there are also heat-production fluctuations in women at different stages of their menstrual cycle. John-Paul is therefore looking at developing personalised

ways of controlling body weight that target thermogenesis, as most weight-loss treatments currently focus on limiting energy in (e.g. by quenching hunger) rather than increasing energy expenditure.

Aidan Kashyap, The Ritchie Centre and Hudson Institute of Medical Research

“A bundle of care for congenital diaphragmatic hernia: bigger lungs, better vessels, and a smoother transition.”



Aidan Kashyap presenting to the Society

Lungs are the one organ of the human body that don't have to function until birth, as a baby will receive its oxygen through the placenta until the cord is cut. When it is cut, babies with congenital diaphragmatic hernia (CDF) have poor lung function and struggle to breathe. The condition is caused when the diaphragm is absent or abnormal, allowing organs such as the stomach, liver, and intestines to protrude into the chest cavity, restricting lung development and resulting in abnormal airways and vascular structures.

Aidan tested three methods to reduce the burden of disease in sheep:

1. Foetal surgical intervention (FETO), which involves inserting a balloon into the airways to force growth and expansion of the lung. He found that this resulted in bigger lungs at birth and improved blood flow to the airways.
2. Giving pregnant mothers a course of sildenafil (the drug contained in Viagra) to treat pulmonary arterial hypertension. This reduced blood pressure in the baby's lungs and increased blood flow and gas exchange (despite still having smaller lungs).

3. Delaying umbilical cord clamping until sufficient lung aeration of the newborn is achieved. This prevents the initial period of hypoxia that newborns with CDF usually experience, therefore protecting the brain from high blood flow (as a baby with hypoxia will generally have increased blood flow to the brain to compensate for a lack of oxygen).

Aidan's studies will now be translated into humans to improve lung development and function of babies born with CDF.

A Joint Win for the RSV's 2018 Phillip Law Postdoctoral Award



The physical sciences – a vast field of enquiry taking in the already broad disciplines of physics, chemistry, meteorology, engineering and technology – share the allure of high research commercialisation potential with the medical sciences. Depending on the field, there is strong incentive for investment by governments and industries in discovering new materials, harnessing the properties they exhibit and applying these to the remarkable technologies they can enable. Arguably, the best projects combine this high potential for commercial value with the intrinsic, principled drive to call forth a better world; conserving energy to minimise carbon emissions, perhaps, or overcoming barriers to successful clinical interventions in otherwise debilitating conditions.

This year, the assessors of the Royal Society of Victoria's Phillip Law Postdoctoral Award in the Physical Sciences worked diligently through the pile of applicants that grows, year on year, with the growth in Victoria's remarkable pool of talent. It is an intensely competitive field of Early Career Researchers and, this year, our assessors simply could not find a way to separate the two lead applicants.

“Both have made – and continue to make – significant contributions to modern physics with different, substantial potential for application,”

explained Dr Peter Baines, the Secretary of the Royal Society of Victoria and one of the assessors. “We were scoring for the quality of each applicant’s total output and contribution, rather than just emphasising citations, patents or contributions to the science community,” explained fellow assessor and RSV Councillor, Dr Tom Beer. Ultimately, the two lead applicants were ruled a dead heat.

The Society congratulates **Dr Sumeet Walia** and **Dr Nishar Hameed** on their joint win of the 2018 Phillip Law Postdoctoral Award for the Physical Sciences!

Dr Sumeet Walia



Dr Sumeet Walia is a Vice-Chancellor’s Research Fellow based at **RMIT University’s** School of Engineering. He has received numerous awards and prizes – including being named one of the region’s top tech innovators – for his research, which involves working with functional materials for small scale electronics, or nanoelectronics. Nanoelectronics is electronics at dimensions that are one billion times smaller than a meter. At such small sizes, materials show unique and exciting properties that are not present at larger scales. These properties can change technological paradigms, allowing small systems to be very energy efficient while displaying remarkable performance over conventional technologies. Sumeet’s work is based on unlocking novel properties in ultra-thin materials and deploying them to demonstrate fascinating next-generation applications in electronics and healthcare. He is developing future semiconducting materials for electronics, chips that can mimic the human brain for storing and recalling past information, smart sensors for health monitoring and miniaturised energy sources. His research relies on multidisciplinary innovation to create functional application-oriented, futuristic platforms for implementation across the breadth of technology.

In 2017, Sumeet was presented with the Victoria University Research Impact Award at the Victorian Young Achiever Awards.

Sumeet attained his Bachelor of Engineering, then his PhD from RMIT, completing in 2013 before working as a Research Fellow, Lecturer and now Senior Lecturer within the School. He extensively supervises young researchers and has successfully brought his research through to patents and commercialisation opportunities, with further high potential in the pipeline.

Dr Nishar Hameed



Dr Nishar Hameed is the group leader of Smart Polymers and Composites Research Group within the Manufacturing Future Research Institute “Factory of the Future” at the **Swinburne University of Technology**.

Prior to joining Swinburne, Nishar was a Research Fellow at Carbon Nexus, **Deakin University**, where he completed his PhD and an Alfred Deakin Post Doctoral Fellowship. Nishar’s research focusses on frontier technologies from advanced composite materials, enabling enormous potential for environmental and economic impact. His achievements include many “firsts” in the field, inspiring follow-up studies, patents and research commercialisation. Nishar recently developed several new technologies to produce smart, flexible and rapid-cure composites that can be integrated to make formable and fibre-reinforced composites, concrete preforms and graphene nanocomposites.

Nishar has won many awards and fellowships as he advances his research career, including a Victoria Fellowship and an Australian Research Council DECRA Fellowship. He supervises an impressive group of PhD and Masters students, and has acted as President of the Carbon Division of the Royal Australian Chemical Institute.

Our thanks to all 2018 applicants, and to assessors Dr Peter Baines, Dr Tom Beer and Dr Kevin Orrman-Rossiter for working through a challenging process! The two winners will be presented with their award certificates and a prize of \$1,500 each, and will share their work via two short talks, delivered at the Royal Society of Victoria on the evening of **Thursday, 27th September**. Join us for “**Faster, Lighter, Smarter**,” and help us to celebrate the accomplishments of two high-achieving, Victorian early career researchers. Booking details are in the earlier events section of the newsletter.

The Gondwanan Floras of the Antarctic Fossil Record

By **Catriona Nguyen-Robinson**
and **Scott Reddiex**

*This article follows a presentation by **Professor David Cantrill** for the 2018 **Howitt Lecture**, an annual, joint*

*presentation hosted by the Royal Society of Victoria and the **Geological Society of Australia, Victoria Division.***

There were once Eucalypts in South America and New Zealand, and South American conifers in Australia. What's the link?

Antarctica.

Professor David Cantrill's interest in the biological sciences was piqued as a child, spending his holidays immersed in nature as he explored the bush on his grandfather's property. While later pursuing a Bachelor of Science at the University of Melbourne, a geologist suggested he take on some geology subjects, given that he had already completed his biology units. Professor Cantrill heeded this advice, and has 'stuck with geology' ever since. Professor Cantrill is now the Executive Director of Science at the Royal Botanic Gardens Victoria and Chair of the Geological Society of Australia, Victoria Division.



Professor Cantrill described his travels in Antarctica – one of the most inhospitable terrestrial environments on Earth – and the crucial importance of its fossil record. The story begins with Joseph Dalton Hooker, a naturalist on the James Clark Ross Antarctic expedition (1839-1843), who was tasked with collecting zoological and geological specimens. During this time, he made plant collections and identified plant species in Antarctica, Australia, New Zealand, and archipelagos in the South Atlantic Ocean. In doing so, he developed a good understanding of the flora and their distribution in these parts of the world, noting similarities between species found in separated regions of the Southern Hemisphere. His work led him to formulate the theory that there was “once more extensive flora, which has been broken up by geological and climatic causes” (1853).

The Earth's crust is a dynamic and volatile environment, comprised of tectonic plates in constant – and often sudden – movement. The movement of these plates shifts the planet's landmasses, like a street-corner magician moving cups around a table with a ball hidden underneath, creating a mosaic-like arrangement of terrestrial continents. At times throughout the Earth's geological history these continents have been relatively disparate, as they are now, while at other times there have only been one or two vast super-continents. During these periods, ecosystems were shared across future continents, and the movements of terrestrial flora and fauna were unrestricted by the oceans.



For hundreds of millions of years Africa, South America, Australia, Antarctica, the Indian subcontinent, and the Arabian Peninsula comprised the supercontinent Gondwana. The landmass had roughly spanned from the equator to the South Pole, and finally fractured into the more familiar continents of our modern era 180 million years ago (mya).

Once at the heart of the Gondwana supercontinent, it is unsurprising that Antarctica holds information on plant species that were once common throughout the Southern Hemisphere. First travelling to Antarctica in the summer of 1991-92, Professor Cantrill has since returned eight times to collect data, sometimes spending up to five months at a time out in the field away from shelter and wildlife. Today, the growth and variety of flora in Antarctica is limited, due to the sheer amount of ice cover and inhospitable conditions; however, Professor Cantrill has dug deeper into the past to uncover the southernmost continent's fossil record, revealing a flourishing environment millions of years ago that supported diverse plant life.

The Permian Gondwanan flora fossils are 254 million years old and are found scattered across

southern landmasses. These flora fossils extend the entire length of the Transantarctic Mountains, and can also be found in the Antarctic Peninsula and Prince Charles Mountains. Some of the earliest fossilised floras recovered were found with the bodies of the explorers on the ill-fated Terra Nova Expedition (1910-13). The samples were identified as *Glossopteris*, a now-extinct genus of seed plant that once covered Gondwana. This genus and its entire plant group was replaced during the Triassic Era by other ferns (e.g. genus *Dicroidium*) and thick-leaved conifers due to the environment becoming warmer and more arid.



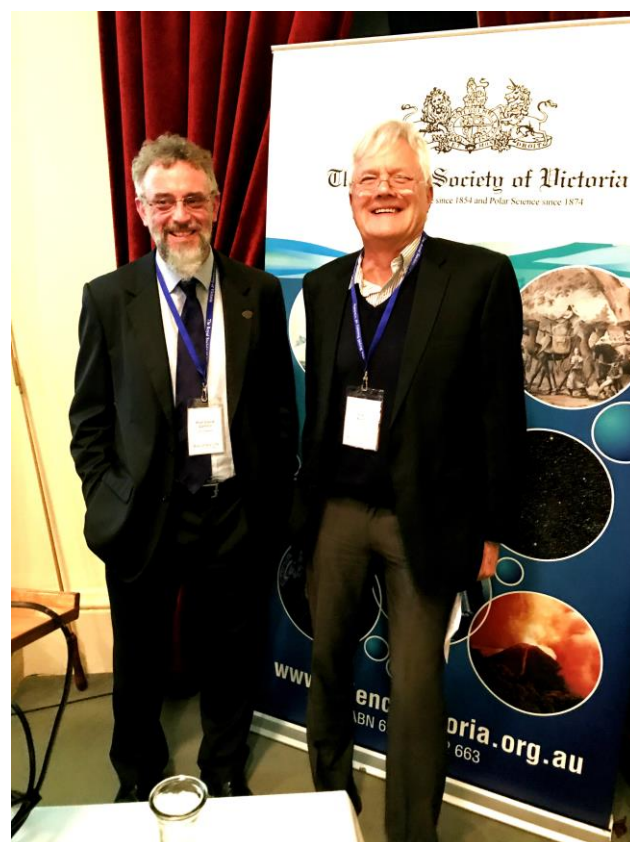
By the Cretaceous Period (120 mya), the supercontinent had started to break up, and Antarctica flora began to form distinct geographical groups: *trisaccate* pollen (also seen in India and Australia), *elaterate* pollen (found in African and South America), and transitional which showed elements of both. Given that almost all of our knowledge of Antarctic Cretaceous and Cenozoic floras is limited to the tip of the Antarctic Peninsula, it is difficult to obtain a complete understanding about the ecosystems and environments that emerged during the Cenozoic Era (66 mya to the present day) from Antarctic samples alone.

Some information can be gathered from the great archives of explorers, such as those of the Swedish South Polar Expedition led by Otto Nordenskjöld, who were stranded on Snow Hill Island for a year. Paintings and sketches over the last two centuries when compared to the present-day landscape can reveal slow changes that have occurred over time, such as the disappearance of glaciers, however are not enough to complete the picture. Professor Cantrill's solution is to visit the icy continent's former neighbours, which, having all previously shared terrestrial ecosystems, lend insight into what previously existed. He has travelled to the Antarctic, South Africa, New

Zealand, and other areas of the southwest Pacific to build a picture of the biodiversity patterns in this part of the globe during the Cenozoic Era.

He found that the landscape of the Southern Hemisphere was quite different to how it looks today. During the Eocene (56-33.9 mya), tropical flora extended throughout Australia into Tasmania and parts of the Antarctic. *Gymnostoma* trees, which are now mostly confined to Queensland and forests in the western Pacific Ocean (e.g. New Caledonia), were once in South America – as evidenced by fossils found there with identical characteristics. Similarly, *Dacrycarpus* conifer fossils in South America are evidence of a group that today is found living in New Zealand, New Guinea and other islands of the western Pacific Ocean.

Professor Cantrill's journey has followed the different the divergent evolution of the climates caused by continental drifting that gave rise to the different floras across the Southern Hemisphere. He collects fossils himself, examines collections of famous explorers, such as Hooker and Nordenskjöld, and develops a picture of the evolution of Southern Hemisphere floras, and in particular, the role that Antarctica has played over time.



GSAV Chair Professor David Cantrill with RSV's Immediate Past President, Dr Bill Birch