



# 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...

**1<sup>st</sup> and 8<sup>th</sup> February: RSV Members' Conference**

**14<sup>th</sup> February:**

*"Rain, Hail or Shine: The Secrets of Severe Weather"*  
**Dr Joshua Soderholm**

**28<sup>th</sup> February: Panel Presentations & Discussion**

*"Fashionable Science: Wearables, Functional Textiles & Circular Fashion"*  
Featuring: **Dr Leah Heiss, Dr Nolene Byrne, Dr Rajesh Ramanathan, Dr Lyndon Arnold**

## March 2019 Advance Notice

**13<sup>th</sup> March:**

*"Origins: How the Earth Made Us"*  
**Professor Lewis Dartnell**

**14<sup>th</sup> March: Panel Presentations & Discussion**

*"The Future of Electronics: Beyond the End of Moore's Law"*  
Featuring: **Associate Professor Meera Parish, Dr Carlos Kuhn, Ms Rebecca Orrell-Trigg**

**28<sup>th</sup> March:**

*"The Marvels of Medicinal Plants"*  
**Dr Tien Huynh**

# February 2019 Newsletter

Print Post Approved 100009741

The Royal Society of Victoria Inc.  
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Melbourne Victoria 3000  
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[rsv.org.au](http://rsv.org.au)

## RSV Members' Conference – the Redevelopment Proposal

Day Two - Friday, 8<sup>th</sup> of February 2019, 10:00am – 1:00pm



### A members-only forum.

The RSV's redevelopment proposal has emerged into the public sphere over the past year as a compelling solution to the Society's chronic resourcing issues. The planning constraint challenges of redevelopment in a heritage precinct are manifold, but the opportunity it presents is undeniable, as is its ability to capture the public imagination. The Society's membership resolved to explore the further development of the proposal at a Special General Meeting held on 21 June, 2018, subject to the suitable management of risk to the Society and the active involvement of our members.



An impression of biodiversity sensitive urban design (BSUD) developed by Sarah Bekessy, Nicholas Williams and Georgia Garrard in collaboration with Mauro Baracco, Jonathan Ware and Catherine Horwill of RMIT's School of Architecture and Design.

Having secured the requisite resources from our partnership with Grocon and Decibel Architecture, we now have an opportunity to really plan the best possible outcome for the Society from the proposed redevelopment. The financial case is largely set, however the scientific and technical case is currently wide open, and presents the opportunity for the Society and its members to embark on a grand experiment in sustainable urban design.

## February at the Royal Society of Victoria

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Members were invited to attend over December and January via email. If you didn't manage to make the first day, then please join us on Friday 8th for an exploration of the opportunities and challenges of delivering both a benchmark proposal for urban sustainability and facilities that are fit for the organisation's 21st century purpose. This second day of our membership conference will commence with a 10:00am arrival, finishing by 1.00pm with some lunch.

During both days of the conference, we are looking at how can we weave our scientific mission into the very fabric of the redeveloped site (both the buildings and the grounds). We have embarked on this journey with experts from a number of fields as well as our architect partners from DeciBel, who share our enthusiasm to deliver a design for the site that is influenced by, informed by and steeped in our scientific knowledge and approach.

On **Day 1** we dreamed big and imagined how the site could be used, led by **Dr Anthony Boxshall** from Science into Action.

Some brief presentations were provided by the following subject experts:

**Professor Bill Melbourne**, MEL Consultants Pty Ltd, Wind Engineering - the engineering challenge

**Associate Professor Nick Williams**, Melbourne School of Ecosystem & Forest Sciences - opportunities to support urban ecology through design

**Professor Tim Entwisle MRSV**, Director, Royal Botanic Gardens Victoria - designing a demonstration site that explains its own science

**Dr Gillian Sparkes**, Commissioner for Environmental Sustainability - using the precinct to monitor environmental data

**Ms Charley Woolmore**, Wurundjeri Council - Indigenous heritage, knowledge and bush food opportunities

**Mr Rob Gell MRSV**, ReThink Sustainability - the site as a showcase for what is possible in sustainable building

**Mr Chris Jones MRSV**, DeciBel Architecture - programming the precinct space (purpose and functions)

Following presentations, we broke into five focus groups over two sessions to capture a breadth of ideas and inputs, then fed these back into a central forum. With these outputs from Day 1, our architect colleagues from DeciBel will turn these ideas into actual design briefs for us to review and build upon further this **Friday, 8 February**.

So on **Day 2**, we get into the details. DeciBel expertise will present our big ideas back to us as official architectural Design Briefs. We will spend the morning refining and improving them, as well as responding to questions and challenges posed by our architects. From this day, and further sharing with RSV members unable to attend, there will be a tangible, tractable set of site elements that can be costed and designed. These will go into the final site redevelopment plan.

Our objective is to weave your big ideas into the fabric of the design for the future of our historic site. For this co-design process, you will need to bring your scientific know-how, your creativity, your ability to constructively challenge yourself and others, as well as a sense of fun. We hope you can participate!

**Subscribed RSV Members only please.** We will be joined by some external colleagues with suitable expertise to contribute to planning. If you are yet to renew your membership for 2019, please contact the RSV office on 9663 5259 or login to your profile at <https://www.joinit.org/o/rsv/members>.



**Places limited, bookings essential!** Lunch from 1:00pm. Register online now at <https://rsv.org.au/events/redevelopment-proposal/>, call or email the RSV office to secure your place: 9663 5259, [rsv@rsv.org.au](mailto:rsv@rsv.org.au).

## Rain, Hail or Shine: the Secrets of Severe Weather

Thursday, 14<sup>th</sup> February 2019 at 7:00pm



**Speaker:**

**Dr Joshua Soderholm**

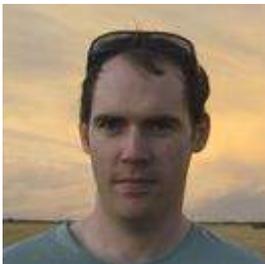
Research Fellow, School of Earth, Atmosphere & Environment  
Monash University

Witnessing hail falling from the sky captures our attention and imagination, especially in places which rarely experience freezing weather. The variety of shapes, sizes and coverage of hail stones, from spiky softballs to deep accumulations of tiny pea hail, continue to challenge our scientific understanding of hailstorms.

However, hail also has a darker side. The impact of hail inflicts damage not only to vehicles and houses, but also to crops and livestock which can't seek shelter. These damages cost the Australian economy hundreds of millions every year, however little has been known about Australian hailstorms until relatively recently.

This lecture unravels the history of hailstorm catastrophes in Australia and explores new technology, techniques and research to offer insight into the evolution of hailstorms and improving their predictability.

**About the Speaker:**



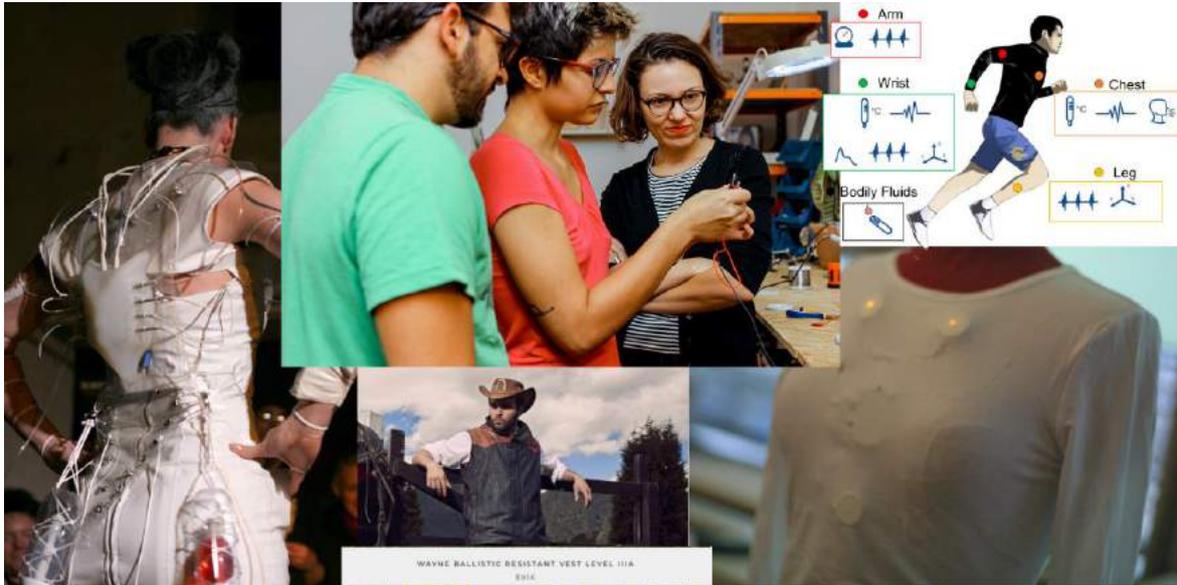
**Dr Joshua Soderholm** is a meteorologist and Research Fellow working with Monash University's School of Earth, Atmosphere and Environment and the Bureau of Meteorology to develop an open weather radar data set and research-grade hail algorithms. Joshua designed and conducted the Coastal Convective Interactions Experiment during his PhD with the University of Queensland to develop a deeper understanding of hailstorms in Southeast Queensland. He also conducts research in paleoclimates and tropical cyclones and provides his expertise to the energy distribution industry.



**Places limited, bookings essential!** *Cocktail function from 6:00pm.* **Register online** now at <https://rsv.org.au/events/rain-hail-shine/>, call or email the RSV office to secure your place: 9663 5259, [rsv@rsv.org.au](mailto:rsv@rsv.org.au). Fully subscribed **RSV Members** can access discounted tickets by registering via their [online profile](#), or call the RSV office to access their **discount code**.

## Fashionable Science: Wearables, Functional Textiles & Circular Fashion

Thursday, 28<sup>th</sup> February 2019 at 7:00pm



### Panel Presentations & Discussion

*“Fashion is the science of appearance”*

*– Henry Fielding*

The laboratory has never been far removed from the catwalk. Science underpins both the technologies and materials used to create trends in fashion. Likewise, good design has much to offer science.

Now more than anytime throughout history, consumers are demanding more than just style and fit from their clothing, and more than just function from their wearable tech. We need great looking textiles which more effectively protect, support, and enhance the wearer, easy-care fabrics which fit our busy lifestyles, ethical fashion with low environmental footprints, and wearables which not only monitor medical conditions but are themselves desirable pieces of jewellery.

Will recycling solutions, circular fashion, creating functional textiles for protection and performance all have a place on the runway?

Join us for an interdisciplinary panel discussing how nanotechnology, material science and innovative design will help shape the future of fashion. **Featuring:**



#### **Dr Leah Heiss**

Leah Heiss teaches the **Master of Design Futures** with **RMIT University’s School of Design**.

She is a Melbourne-based artist and designer whose practice is located at the nexus of art, design and science – using advanced technologies to develop potent human scale projects. Her process is deeply collaborative, working with experts from nanotechnology through to manufacturing.

Current projects include new forms for hearing technologies, biosignal sensing jewellery, emergency jewellery for times of crisis, swallowable devices to detect gas fluctuations within

## February at the Royal Society of Victoria

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the body, and ongoing experimentation with next-generation materials such as magnetic liquids, memory metals, and electricity conducting textiles.

She has won five Good Design Awards and her work is part of Museums Victoria's heritage collection.



### Dr Nolene Byrne

Dr Nolene Byrne is a **Senior Lecturer at Deakin University**, Australia with a joint position within the **School of Engineering** and the **Institute for Frontier Materials**.

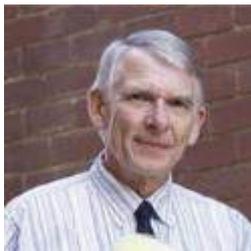
Nolene's research and teaching interests centre on understanding process/structure/property relationships in polymers. A particular interest is in circularity and how sustainability and value can be added to waste by innovative processing, material design and product development. Nolene was a member of H&M Global Change Award in 2017 for a denim recycling technology.



### Dr Rajesh Ramanathan

Dr Ramanathan is currently a **Senior Research Fellow** at the **School of Science, RMIT University**.

He has a cross-disciplinary expertise that spans from physical sciences (materials chemistry) to biological sciences (microbiology, biochemistry, biotechnology and bioinformatics); engineering (nanotechnology) and statistics (chemometrics). His broad expertise in academia as well as industrial experience has enabled him to lead and contribute to several research projects across disciplinary boundaries. His current research has a strong focus on development of new nanomaterials for biosensor technologies with commercial potential, for example his recent development of nano-enhanced textiles that can spontaneously clean themselves of stains by simply putting them under sunlight or even a light bulb.



### Dr Lyndon Arnold

Dr Arnold is a **research physicist** with over 45 years' experience. He has worked in textiles for 18.5 years (CSIRO) plus 12.5 years at **RMIT University**.

Dr Arnold has accumulated extensive experimental and theoretical experience in fields as diverse as acoustics and vibration, sound propagation, radar, atmospheric/stratospheric physics, general meteorology, geophysics, microseismics, coal mine explosions, fibre science and textiles, protective fabrics, and ballistic, stab and blast protection. He has particular interest and expertise in experimental physics.

His textile research has covered a broad range of fibre properties, textile production and fabric performance. His recent textile and fibre research includes the development of patented fibre-blend ballistic fabrics for protection against high-speed projectiles, and protective fabrics to mitigate the effects of high-speed impacts from blast debris.



**Places limited, bookings essential!** *Cocktail function from 6:00pm. Register online* now at <https://rsv.org.au/events/fashionable-science/>, call or email the RSV office to secure your place: 9663 5259, [rsv@rsv.org.au](mailto:rsv@rsv.org.au). Fully subscribed **RSV Members** can access discounted tickets by registering via their [online profile](#), or call the RSV office to access their **discount code**.

## Origins: How the Earth Made Us

Thursday, 13<sup>th</sup> March 2019 at 7:00pm



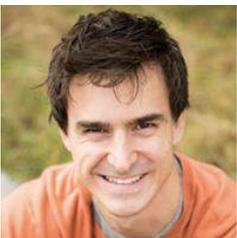
### Speaker: Professor Lewis Dartnell Life Sciences, University of Westminster

As a species we are shaped by our environment. Geological forces drove our evolution in East Africa; mountainous terrain led to the development of democracy in Greece; and today voting behaviour in the United States follows the bed of an ancient sea. The human story is the story of these forces, from plate tectonics and climate change, to atmospheric circulation and ocean currents.

How are the Himalayas linked to the orbit of the Earth, and to the formation of the British Isles? By taking us billions of years into our planet's past, **Professor Lewis Dartnell** tells us the ultimate origin story. When we reach the point where history becomes science we see a vast web of connections that underwrites our modern world and helps us face the challenges of the future.

From the cultivation of the first crops to the founding of modern states, Professor Lewis Dartnell, author of the newly released book 'Origins: How the Earth Made Us', reveals the Earth's awesome impact on the shape of human civilizations.

#### About the Speaker:



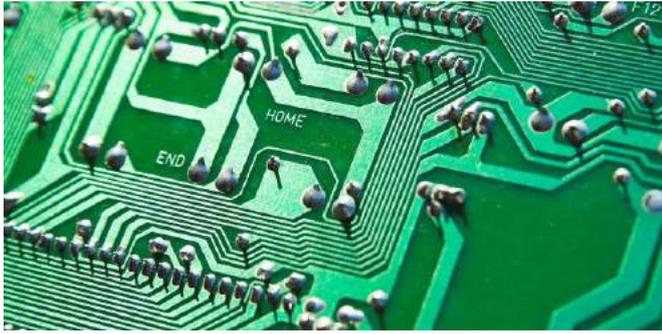
**Lewis Dartnell** is an astrobiology researcher and professor at the University of Westminster. He has won several awards for his science writing, and contributes to the Guardian, The Times and New Scientist. He has also written for television and appeared on BBC Horizon, Sky News, and Wonders of the Universe, as well as National Geographic and History channels.

A tireless populariser of science, his books include the bestselling 'The Knowledge: How to Rebuild Our World from Scratch', and the newly released 'Origins: How the Earth Made Us'.

**Eventbrite**

**Places limited, bookings essential!** *Cocktail function from 6:00pm.* Register online now at <https://rsv.org.au/events/origins/>, call or email the RSV office to secure your place: 9663 5259, [rsv@rsv.org.au](mailto:rsv@rsv.org.au). Fully subscribed **RSV Members** can access discounted tickets by registering via their [online profile](#), or call the RSV office to access their **discount code**.

## The Future of Electronics: Beyond the End of Moore's Law



Thursday, 14<sup>th</sup> March 2019 at 7:00pm

A joint presentation with the ARC Centre of Excellence in Future Low-Energy Electronics Technologies (FLEET)

### Panel Presentations & Discussion

Computing has transformed the world, but there is a price: the huge amount of energy

being consumed by massive, factory-sized data centres means that information and communications technology (ICT) already consumes about 8% of global electricity, and is doubling every decade. ICT now has the same global-warming contribution as the aviation industry.

At the same time, we are running out of achievable ways to improve the efficiency of existing, silicon-based (CMOS) electronics. 'Moore's Law', which for 60 years predicted ever-smaller, ever-more-efficient computer components, is expected to be declared officially dead in next ten years. Without a 'beyond CMOS' solution, energy will become the limiting factor on further computational growth in the next one or two decades, severely limiting our potential to expand Artificial Intelligence, an Internet of Things, and 'self-drive' vehicles. For computing to continue to grow, we need to develop new electronics that consume much less energy.

Join us for an electrifying panel where three scientists from **FLEET** will describe new fields of physics and new materials in which electrical current can flow with much lower energy wastage.



#### Featuring:



**Associate Professor Meera Parish** is a theoretical physicist at **Monash University**, where she investigates the fundamental behaviour of quantum particles and how they organise into exotic states of matter, such as superfluids. These states could form the basis of new ultra-low energy electronics.

**Dr Carlos Kuhn** studies ultra-cold atomic gases at **Swinburne University of Technology**, investigating the behaviour of atoms at a millionth the temperature of outer space. As a passionate science educator, Carlos has used water-powered rockets to inspire students to study science!



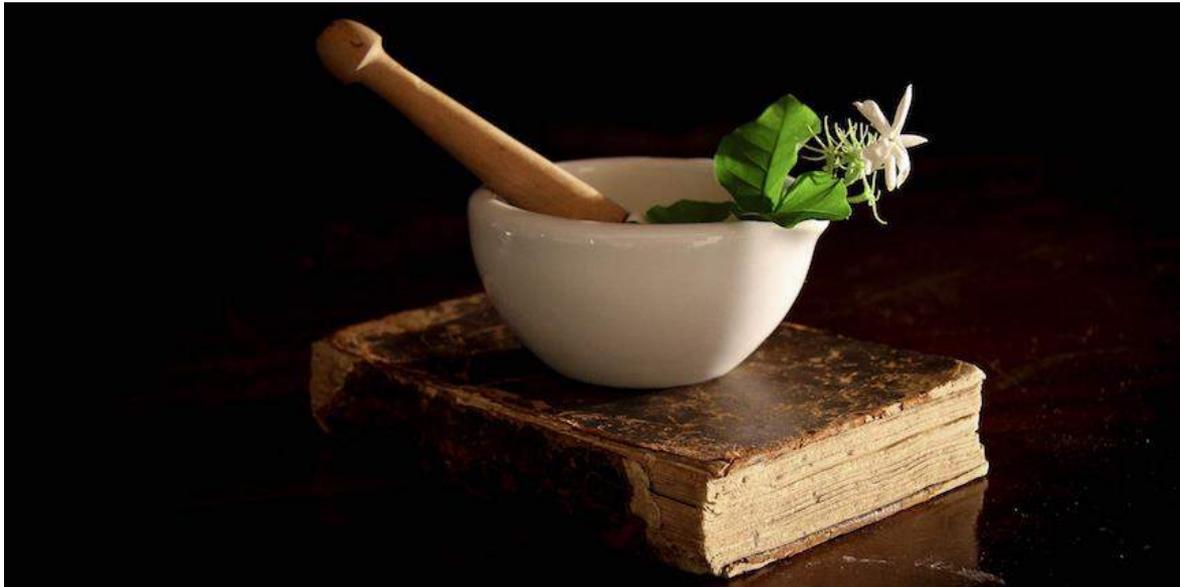
**Rebecca Orrell-Trigg** is a PhD student recently transferred to **UNSW** from **RMIT University**, where she has used liquid metals to synthesise two-dimensional materials for future electronic devices. This work allows her to apply her inorganic chemistry knowledge in a practical setting, and use her extensive experience with touch printing.

**Places limited, bookings essential!** Cocktail function from 6:00pm. Register online now at <https://rsv.org.au/events/future-of-electronics/>, call or email the RSV office to secure your place: 9663 5259, [rsv@rsv.org.au](mailto:rsv@rsv.org.au). Fully subscribed **RSV Members** can access discounted tickets by registering via their [online profile](#), or call the RSV office to access their **discount code**.

**Eventbrite**

## The Marvels of Medicinal Plants

Thursday, 28<sup>th</sup> March 2019 at 7:00pm



### Speaker: Dr Tien Huynh Senior Lecturer in Biosciences, RMIT University

Plants are the marvels of the earth and the unsung heroes of our planet. They provide the air we breathe, the houses we live in and the food we eat. In an era where we have an abundance of food, yet are starving for nutrients, what can we consume to be healthier?

In this talk, Dr Tien Huynh will delight both your brain cells and your taste buds. Discover Tien's recent research to unlock the secrets of medicinal plants revealing how plants can heal us from the inside out. Plants highlighted in the discussion will range from the familiar, like coffee, to those which many people have never seen or used before.

**Taste-test a selection of these plants during this event**, and be inspired to share your new knowledge of medicinal plants and their amazing properties with loved ones. Together we can eat well, live well and be well.

#### About the Speaker:



**Dr Tien Huynh** was born in Vietnam and immigrated to Australia, seeking asylum as a refugee from the Vietnam War with no English speaking skills and nothing but the clothes on her back. Tien found her passion in science at university under the tutelage of an amazing mentor, Professor Ann Lawrie.

From there, Tien went on to complete her doctorate at the University of Melbourne and postdoctoral research overseas (England and Italy) in Evolutionary Phylogenetics and Conservation Biology before returning to Australia to specialise in Cancer, Tissue Repair, Neuropharmacology and Drug Discovery Technologies. Tien is now a Senior Lecturer in BioSciences at RMIT University.

Tien is passionate about environmental sustainability, medicinal plants and conservation. Recently, Tien was recognised as a Superstar of STEM as an ambassador and role model to inspire the next generation of scientists to bridge the gap between gender, age and cultural differences.

**Places limited, bookings essential!** *Cocktail function from 6:00pm.* Register online now at <https://rsv.org.au/events/marvels-of-medicinal-plants/>, call or email the RSV office to secure your place: 9663 5259, [rsv@rsv.org.au](mailto:rsv@rsv.org.au). Fully subscribed **RSV Members** can access discounted tickets by registering via their [online profile](#), or call the RSV office to access their **discount code**.



## Nominations for RSV Membership

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

Ms Kate **FERRIS**, PhD Student  
Mr Simon **WINDLEY**, PhD Student  
Ms Vicki **HALLETT**, Musician  
Dr Gillian **SPARKES**, Commissioner for Environmental Sustainability  
Professor Allan **RODGER**, Retired  
Mr Michael Joseph **BRENNAN**, Director of Photography  
Dr Jemma **CRIPPS**, Scientist, DELWP

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 14<sup>th</sup> March 2019. Recently elected members who have not yet signed the Society's membership book are warmly invited to attend the 8<sup>h</sup> November 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.**

### From the President

What a great start to our RSV year. I hope you have had an enjoyable Festive Season and summer break - if you were able to.

Now that we are in February it is the start of a very busy year for RSV members. Early February sees a two-day members' Forum to discuss different aspects of our proposed new building project. We hope members will take this opportunity to participate and present your views – we will endeavour to share outcomes online for further input.

Our February lectures have exceptional topics and outstanding speakers. Full details are earlier in this newsletter.

I have asked our Vice-President Nic Williams to stand in for me over the next 6 weeks as I become a new (left side) hipster. I'll be recuperating and relaxing, whilst regrettably not being able to attend our exciting program.

I remain contactable on 0418 346 999 or by email at [president@rsv.org.au](mailto:president@rsv.org.au) if you have any issues you want to discuss.

I look forward to seeing you at our March program events.

- **David Zerman, RSV President**

## RSV Profile: Mr David Zerman, President

By **Priya Mohandoss MRSV**



**"Think like a proton, stay positive." David Zerman in the Phillip Law Room.**

Attributable to his experience and expertise in the field not-for-profit leadership, management and fundraising, David Zerman has been an invaluable asset to the Royal Society of Victoria. David has been an active member for more than ten years and has held the role of President since 2017.

He has worked in a senior executive capacity for organisations such as the Royal Flying Doctor Service (Victoria), the Royal Melbourne Hospital Foundation and the National Stem Cell Foundation, as well as voluntarily providing training throughout Southeast Asia. David gains much satisfaction from imparting his knowledge to these societies, allowing them to access, utilise and adapt resources for their specific circumstances and requirements.

Although David has made his mark in terms of professional fundraising in health and medical areas, his enthusiasm for science began when he observed Sputnik 1, Earth's first artificial satellite, orbit the skies in October 1957. From then on, he has maintained his thirst for knowledge and embraces the role the Society plays to engage others with an assortment of topics concerning the sciences, throughout the State, since its inception in 1854.

In the future, he would like this sort of activity to expand, especially to equip the next generation, with the Society itself offering a beacon for scientific pursuit in Victoria.

Along with being RSV President, David also plans to continue his PhD at the Centre for Social Impact, Swinburne, with a focus on philanthropic support for health and medical research institutes in Australia.

### 2019 RSV Council Elections

Thanks to all members who have agreed to be nominated for the officer and ordinary member positions on Council for the 2019 to 2021 period.

**Council Officers:** We received a single nomination for each of the advertised officer positions. Accordingly, we are pleased to advise the following RSV members, are deemed elected to the officer roles for the 2019– 2021 Council:



- Mr David Zerman, President
- Mrs Nicola Williams, Vice-President
- Mr Andrew Davison, Treasurer
- Dr Peter Baines, Secretary

Congratulations to all! These officers will comprise the RSV's next Executive Committee following the **9 May AGM**, and will be joined by Dr William Birch AM as Immediate Past President.

**Ordinary Members:** As we have received eight excellent nominations for the five

positions of ordinary member of Council, an election will be held. Electoral materials accompany this newsletter in the hard copy mail-out to all RSV members with voting rights.

### Please Renew Your Membership

Please ensure you are a financial member of the Society, particularly before voting. Materials have recently been mailed to all members due for subscription renewal; you can also call the RSV office on 9663 5259, or log on to your membership profile at <https://www.joinit.org/o/rsv/members> to renew.

### International Day of Women and Girls in Science

#### Live Streaming/Online Event

Monday, 11<sup>th</sup> February 2019

We invite girls enrolled in mid-secondary school and their teachers to join a special celebration of the International Day of Women and Girls in Science for 2019.

Together, **Dr Amanda Caples**, Victoria's Lead Scientist, **Dr Gillian Sparkes**, the Commissioner for Environmental Sustainability Victoria, **Dr Angie Bone**, Victoria's Deputy Chief Health Officer and the Environmental Protection Authority's Chief Environmental Scientist, **Dr Andrea Hinwood**, will join an interactive web-streamed panel session aimed at middle school and high school students in science, hosted by the Royal Society of Victoria.

The event will feature a keynote address by **Dr Marguerite Evans-Galea**, Co-Founder and CEO of Women in STEMM Australia, followed by an interactive web-streamed panel, facilitated by **Dr Bridie O'Donnell**, Head of the Office for Women in Sport and Recreation.

\*

This web-streamed event is open to all Victorian Schools to participate and panellists will be taking questions from students all over Victoria.



Register your class now at <https://rsv.org.au/events/idwgs-2019/>

## Drew Berry's Molecular Machines

by **Catriona Nguyen-Robertson MRSV**  
RSV Science Communications

*This article follows a lecture presented to the Royal Society of Victoria by Dr Drew Berry titled "[Molecular Machines: Creating Flesh and Blood](#)" on Thursday, 25<sup>th</sup> of October 2018.*



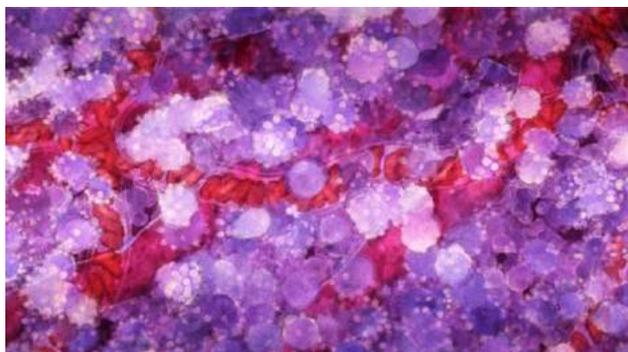
According to Dr Drew Berry, the public has “a huge appetite for science”, but scientific research is often “buried in language” filled with jargon, making it difficult for the lay audience to comprehend the complexities of cell biology. Dr Berry rose to this challenge of accessibility by combining science with art and animation to reveal the microscopic processes that occur inside our bodies.

As a high school student, Dr Berry “watched too much television” and loved science documentaries. After hearing about Calypso, a former British Royal Navy minesweeper that was converted into a research vessel

by Jacques-Yves Cousteau for diving, filming and oceanographic research, Dr Berry wanted to travel around the world as a marine biologist. He quickly signed up to be a rescue diver and began studying marine biology at the University of Melbourne, where he was introduced to cell biology. There, Professor Jeremy Pickett-Heaps showed him cells under the microscope that looked like liquid gold along with videos of how the individual cells interact and move, and he became fascinated by them.

At the same time as being “surprised and inspired by microscopy,” Dr Berry was fascinated by the development of technology. He wrote his PhD thesis on the Amiga 500 in 1987, a computer that was ahead of its time back then, especially in terms of its graphics – vital for someone who has always played video games for the graphics rather than the gameplay! Alongside his studies, he created animations of human cells for children’s education purposes.

Dr Berry later switched careers to advertising, where he learned to use Photoshop, and in 1995 he combined his hobby in graphic design with cell biology to begin work as a biomedical animator at the Walter and Eliza Hall Institute (WEHI). In this role, he combs scientific literature and weaves it into a story with comprehensible language and visuals.



**Red blood cells moving in blood vessels (capillaries) interspersed through tissue**

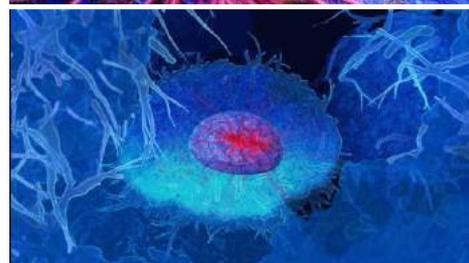
As an animator, most of Dr Berry’s days are spent reading scientific literature and going on long walks to think about what he reads while his computer runs tasks. There is a great deal of data on cellular processes, however the full story is often scattered among multiple studies and papers (i.e. all the details of one machine complex may be comprised of multiple proteins that work together, and each is described individually). Dr Berry therefore has to piece the jigsaw puzzle together to show the big picture while keeping

the smaller details accurate. He also has to make artistic choices that may not always reflect the science of what’s going on. Colour is not relevant at the cellular and molecular levels; but he uses



it in his animations to evoke moods and emotions, allowing him to better engage his audiences and also make it easier to distinguish between different components and processes of a cell.

Cell division and DNA replication are complex processes that involve multiple proteins to form cellular machinery. DNA exists as a double helix structure composed of two complementary strands (i.e. the two strands match and the sequence of one determines the other). During replication, the helix structure is unzipped and unwound so that each individual strand serves as a template for the production of its counterpart. In this still from his animation of the “DNA Replisome,” multiple enzymes (proteins) come together, each with a different role: one unwinds the double helix (*helicase*), one builds the new strands (*DNA polymerase*), and another joins newly-made DNA fragments together (*DNA ligase*). To see how DNA is stored in cells and replicated, you can view his animation online at: <https://www.wehi.edu.au/wehi-tv/molecular-visualisations-dna>.



Once the cell has produced two identical replicas of its DNA, it can divide into two identical cells, the first step of which is prophase. During prophase, DNA content (*chromatin*) condenses, to become increasingly compact (making it visible under the microscope at this stage) and a structure called the *mitotic spindle* starts to form. The mitotic spindle is comprised of long *microtubule* proteins that form at opposite ends of cell to help separate the two identical copies of DNA so that it divides equally between the two new cells formed. Dr Berry has studied how proteins “step along” along the microtubules in great detail and is exploring their dynamics to determine how it works as a “signal broadcasting system”.

Several of Dr Berry’s recent projects include WEHI’s *Illuminarium*, a revolving LED-light installation spanning six-stories that displays images featuring the latest medical research at dusk and dawn, animating human/alien hybrid DNA for Keanu Reeves in the film *The Day the Earth Stood Still*, and an animated video of Bjork’s cells and tissues to accompany her song [Hollow](#) (a dream come true as someone who had a crush on her as a teenager!). His works have travelled the globe, having made appearances in the Guggenheim Museum and Centre Pompidou, and his animations depicting molecular processes such as DNA replication and DNA transcription, have toured many a school classroom and university lecture theatre as a popular learning tool.



**RSV President David Zerman, Dr Drew Berry and RSV Councillor Dr Catherine de Burgh-Day (Vote of Thanks)**

Most of Dr Berry’s products are aimed at high school students, but his audiences now extend far beyond as he continues to undertake science outreach. His works have travelled to various museum exhibits and galleries. In 2014, he worked with a team to create the [E.O. Wilson’s Life on Earth](#) biology e-textbook, which can be downloaded for free. This interactive

high school textbook has revolutionised students’ learning experience. It includes narratives and image libraries for students to zoom in, zoom out, and rotate for a more hands-on learning experience.

His ultimate dream is to see students exploring cells with virtual reality and augmented reality in the classroom using their mobile phones. He believes that science should be accessible and that it should be shared, driving him to create these vibrant and informative animations that are now displayed around the world.

## Restoring Sight & Visualising Immunity Honouring the 2018 RSV Research Medallists

by **Catriona Nguyen-Robertson MRSV**  
RSV Science Communications



On the 13th of December, Her Excellency the Honourable Linda Dessau AC, Governor of Victoria, presented **the Royal Society of Victoria's Medal for Excellence in Scientific Research** to **Professors Anthony Burkitt and Jamie Rossjohn** (en route to induct the new Victorian Premier and Cabinet!).

Professor Burkitt leads a consortium of Australian universities and institutes to develop a bionic eye and technology, Bionic Vision Australia, and Professor Rossjohn is a leader in the field of immunology, in his quest to better understand how the immune system works and can be manipulated to address disease. The RSV Research Medal awarded to two leaders in their fields recognises both their research career achievements as well as their impact in the scientific community through mentorship and public engagement.

### Vision Restoration through Medical Bionics

*2018 RSV Medallist for Excellence in Scientific Research: **Professor Anthony Burkitt**, Research Director of Bionic Vision Australia and Professor of Engineering at the University of Melbourne, Department of Biomedical Engineering*

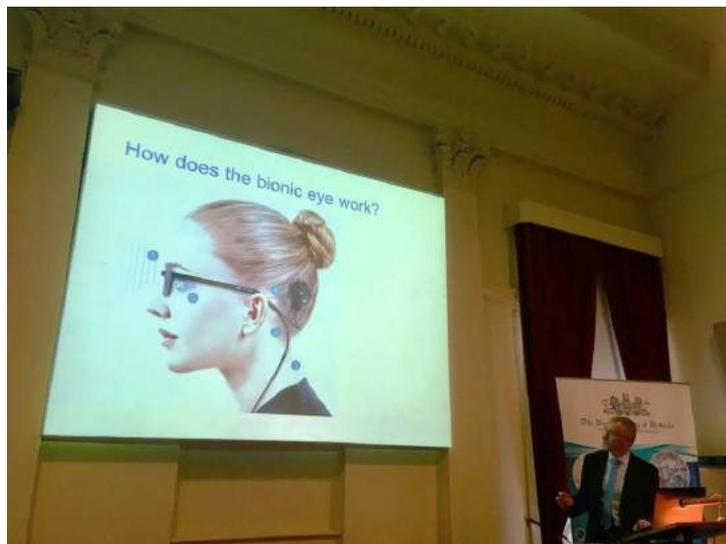


**RSV Medallist Professor Anthony Burkitt with the Governor of Victoria**

Professor Burkitt grew up among a family of doctors, but decided that medicine wasn't the right path for him, wanting to do something "with much more direct input" on people's lives. As a student, he loved physics and mathematics, and now draws upon these as an interdisciplinary scientist with a "clear vision to work towards a single goal": to develop the bionic eye.

Australia played a significant role in the development of bionic technology. Teleelectronics was Australia's first successful high-tech medical electronics company that pioneered the implantation of medical devices into the body safely in the context of heart pacemakers. Based on that early work, Professor Graeme Clark invented the cochlear implant that converts sound into electrical impulses to be picked up by sensory nerves in the ear, thereby restoring hearing. It was these foundations that Professor Burkitt built upon to successfully restore vision with a bionic eye.

The retina contains photoreceptors (rods and cones) and nerves to provide vision. Photoreceptors transform light into electrical signals that are sent to the brain via the optic nerve. If the photoreceptors die, a person is left with no visual percept, however, the surviving nerve cells can be targeted to restore their sight. Professor Burkitt and his team built a wearable camera (embedded into glasses) that can bypass the defunct photoreceptors: the camera records images, which are processed, then sent to implanted platinum electrodes in the retina that transmit electrical signals for the surviving nerve cells to receive and send on to the optic nerve. This device provides patients with a pixelated vision of the world based on the number of electrodes implanted, and is only becoming clearer and more detailed as the technology and software is developed. The three patients who received this device in the first trial became a part of the research team, providing direct understanding to what patients could see and what could be improved.



**Professor Anthony Burkitt demonstrates the operation of the bionic eye to the Royal Society of Victoria**

In the transition to a less invasive alternative, Professor Burkitt collaborated with a large team to develop a brain-machine interface with enhanced biocompatibility and high-resolution functionality that is implanted with minimal trauma [i]. Neural implants are often connected to the brain by sitting either on the brain's surface or being placed in the cortex, while his team places the implant in blood vessels of the brain. The technologies developed by Bionic Vision Australia are now being commercialised and are undergoing patient trials. With both the bionic eye and this

next-generation brain-computer interface, Professor Burkitt's research will not only provide great benefit to vision-impaired patients, but to a range of applications that use brain-computer interface technology.



**RSV Medallist Professor Jamie Rossjohn with the Governor of Victoria**

### **Visualising Immunity: Knowing Your MAITs**

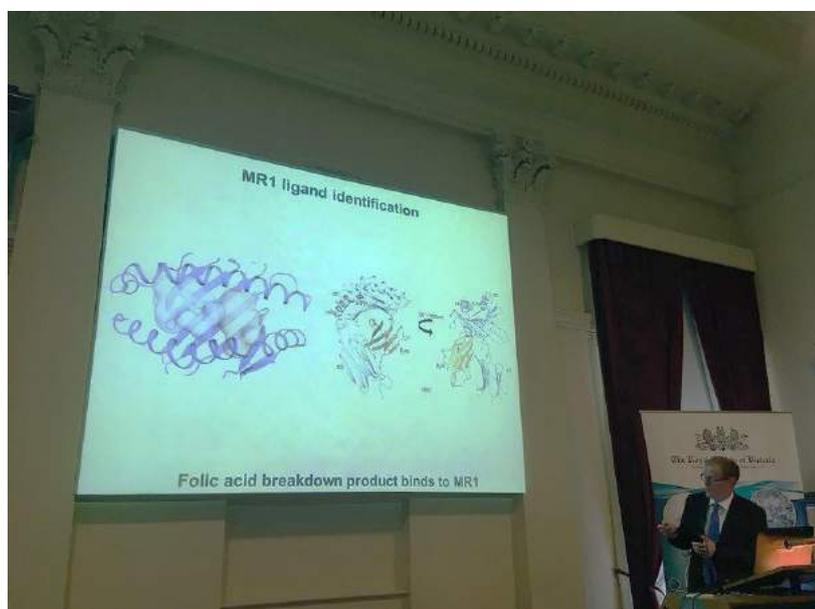
*2018 RSV Medallist for Excellence in Scientific Research: **Professor Jamie Rossjohn**, Head of the Infection and Immunity Program, Monash Biomedicine Discovery Institute*

During his high school years, Professor Rossjohn developed a liking for biology and

chemistry, which was nurtured by teachers and mentors. Since 2002, he has undertaken independent research to better understand the immune system. Following on from Professor Burkitt's talk, he agreed that the eye is a "powerful sensor", however it can "only see so much". Professor Rossjohn explores what is invisible to the naked eye, requiring the Australian Synchrotron, a "football field-sized microscope" to see the fundamental, molecular mechanisms of the immune system. The Synchrotron produces intense beams of light that are more than a million times brighter than the sun, which Professor Rossjohn uses to explore structural biology – the shapes and behaviours of molecules and their interactions with cells – and produce images of these complex processes.

Central to the immune system are T cells, which kill infected cells to limit the spread of an infection, or coordinate and provide help to other immune cells. During an infection, proteins pick up parts of bacteria and viruses and display them to T cells as a beacon (T cells will not interact with the bacteria or viruses otherwise). Most T cells recognise bacterial or viral signatures when presented with the protein MHC, however Professor Rossjohn focuses on the more 'unconventional' T cells that require other proteins. One such group of T cells are termed 'mucosal-associated invariant T' (MAIT) cells, which see bacterial components presented by an MHC-related (MR1) protein instead.

MAIT cells account for a significant proportion of T cells, especially in mucosal areas such as the gut and liver, and are one of the faster groups of cells that respond to infection. For a long time, they were known to be activated to kill bacteria and yeast, but the exact signatures from bacteria and yeast they recognise were unknown. Dr Lars Kjer-Nielsen, a postdoctoral researcher in Professor Jim McCluskey's Laboratory at the University of Melbourne, observed that when growing MAIT cells in vitro (tissue culture), even the cells growing in the absence of bacteria were entering into a state of activation, indicating that a component of the tissue culture media (containing nutrients for cells to survive and grow) could activate MAIT cells. He identified the activating compound as vitamin B derivatives, made during the production of vitamin B2 [i]. In collaboration with the McCluskey group, Professor Rossjohn's team determined the structure of MR1 in complex with vitamin B derivatives to learn how they potently activate MAIT cells. Importantly, the pathways that produce these metabolites are unique to bacteria (our bodies can't make these compounds), making them an ideal target for T cells, however we do consume them in Berocca vitamin tablets, Victoria Bitters beer, Vegemite, and Voltaren anti-inflammatory drugs. Professor Rossjohn is further investigating the role of MAIT cells in the immune system, and his work to date has shown promise for being able to manipulate these cells in disease.



**Professor Jamie Rossjohn explains the process by which MAIT cells activate an immune response to B vitamin derivatives to the Royal Society of Victoria**

[i] Oxley et al. 2016 Nature Biotechnology <https://www.nature.com/articles/nbt.3428>

[ii] Kjer-Nielsen et al. 2012 Nature <https://www.nature.com/articles/nature11605>