



The
Royal Society
OF VICTORIA
Promoting science since 1854

PATRON: The Hon Linda Dessau AC
Governor of Victoria

PRESIDENT: Mr David Zerman

September Events:

**11th September: Public Lecture @
Government House**

*Victoria's Environment – Adapting to
the New Normal*

*With **Dr Pandora Hope,**
Professor Roslyn Gleadow,
Professor Richard Eckard, Professor Nigel
Tapper and Associate Professor Anthony
Boxshall (MC)*

12th September: Darkness Visible Down Under

*With **Associate Professor Alan Duffy***

26th September: Fire and Pyrodiversity in the Anthropocene

*With **Dr Luke Kelly***

October Advance Notice:

2nd – 4th October: Evolutionary Transformations in Vertebrate History

AAS Boden Conference @ Melbourne Museum

10th October: What are Fungi Doing for our Bushlands?

*With **Dr Sapphire McMullan-Fisher***

24th October: Phillip Law Postdoctoral Award Lecture

September 2019 Newsletter

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Melbourne Victoria 3000
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rsv.org.au

Victoria's Environment: Adapting to the New Normal

Wednesday, 11th September from 5:00pm

Government House



The Governor of Victoria, the Hon. Linda Dessau AC, and Mr Anthony Howard AM QC invite members of the public to attend a free public lecture at Government House, Melbourne on Wednesday 11 September 2019.

Some of Victoria's leading environment and science experts will speak on the innovative ideas and solutions currently being developed to adapt to the challenges of Victoria's climate.

Associate Professor Anthony Boxshall MRSV, Principal of Science into Action, will moderate a panel discussion with:



Professor Ros Gleadow MRSV, Professor of Plant Sciences, Monash University

Professor Richard Eckard, Director of the Primary Industries Climate Challenges Centre, The University of Melbourne

Professor Nigel Tapper, Professor of Environmental Science, Monash University and the Water Sensitive Cities Cooperative Research Centre

Dr Pandora Hope, Principal Research Scientist, Australian Bureau of Meteorology

Attendance is free; however, registration is essential as seating is limited. Dress is smart casual or business attire.

Attendees are asked to bring a form of photo identification and will be required to undergo security screening involving wand and bag checks on arrival at Government House. Please note there is no parking on site for this event. Gates open at 5.00 pm. Please be seated by 5.45 pm. Refreshments will be served following official proceedings.



Places limited, bookings essential! Register online now at <https://rsv.org.au/events/the-new-normal/>.

Darkness Visible Down Under

Thursday, 12th September at 7:00pm



Speaker: Associate Professor Alan Duffy

*Astrophysicist, Centre for Astrophysics and Supercomputing, Swinburne University
Lead Scientist, Royal Institution of Australia*

Decades of research have led astronomers to a staggering conclusion: there exists an invisible type of mass that outweighs everything we can see five times over. Join Associate Professor Alan Duffy, who will explain how we know so much about the properties of a particle we have yet to discover, and how Australia is playing a leading role in uncovering the nature of this mysterious dark matter with SABRE, the world's first dark matter detector at Victoria's Stawell gold mine.

About the speaker:



Associate Professor Alan Duffy is an astrophysicist creating universes on supercomputers to understand how galaxies form and to probe the nature of dark matter. He often gets to explain this work to as wide an audience as possible on TV, radio and public events.

He is currently based at the Centre for Astrophysics and Computing at Swinburne University. Previously he was a postdoctoral researcher at the University of Melbourne, and a postdoctoral research associate with ICRAR at the University of Western Australia. Alan obtained his PhD from the Jodrell

Bank Centre for Astrophysics at the University of Manchester and spent time as a postgraduate at the Sterrewacht, Leiden Observatory in The Netherlands.

Alan is a member of SABRE, the world's first dark matter detector in the Southern Hemisphere, based at the bottom of a gold mine at the Stawell Underground Physics Laboratory in Victoria, Australia.

As a member of two leading surveys on the next-generation Australia Square Kilometre Array Pathfinder telescope he creates local universe simulations that can be used to test our galaxy formation and dark matter theories when compared with observations from the WALLABY and DINGO surveys.



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

Fire and Pyrodiversity in the Anthropocene

Thursday, 26th September at 7:00pm

Speaker:

Dr Luke Kelly

Senior Lecturer, School of Ecosystem & Forest Sciences, The University of Melbourne

Fire has shaped the diversity of life on Earth for millions of years. Variation in fires continues to be a source of biodiversity across the globe and many ecosystems depend on particular patterns of fire.



Although people have been using fire to modify environments for millennia, the cumulative effects of human activities are now changing patterns of fire at a global scale in novel ways, to the detriment of biodiversity, people and the ecosystems on which all of life depends. Conservation of biodiversity under emerging fire regimes is complex because of the unique changes we are only just starting to see - including fires from the Arctic to the Amazon - and the unprecedented scale over which they may transform ecosystems. Addressing these challenges requires new ways of predicting changes in ecosystems and fresh approaches to fire management.

Ecologist Dr Luke Kelly argues that integrating preferences and knowledge of people with new ways of predicting changes in ecosystems will produce more effective fire management in a rapidly transforming world. He explores trends affecting fire regimes and biodiversity across the globe and identifies new ways of predicting changes in fire and biodiversity to capture drivers and tipping points under future fire regimes. Join us to learn which actions will contribute to a more effective and anticipatory management of fire and biodiversity in the Anthropocene.

About the speaker:



Dr Luke Kelly is a Senior Lecturer in Ecology at the University of Melbourne who enjoys contributing solutions to global conservation problems. His research interests are in ecology and evolution, biodiversity conservation and decision-making. Much of his work is focused on understanding animal and plant responses to fire and climate change. This includes doing field experiments, building models and working closely with policy makers.

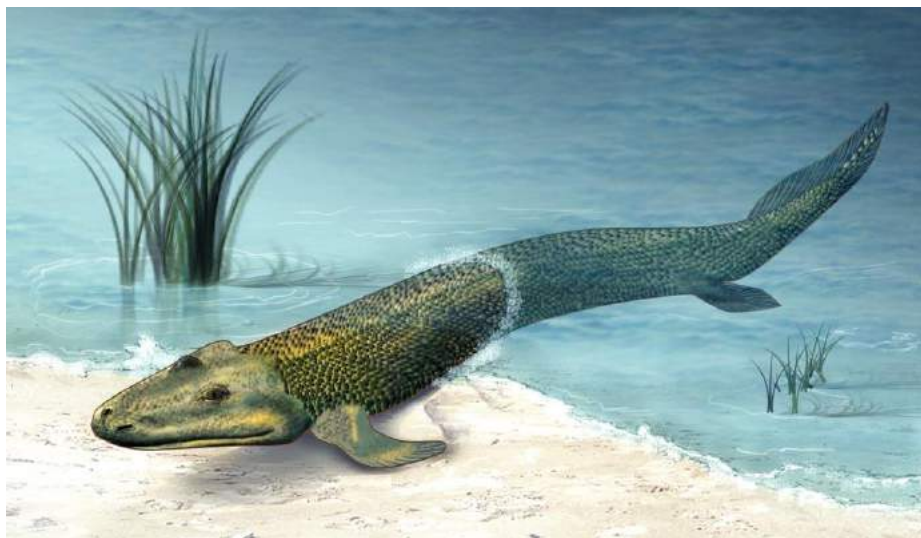
In 2018, Luke was awarded a Centenary Fellowship by the University of Melbourne to start new research on plants, evolutionary adaptation and global change. From 2015-2017, Luke was based in Spain at the Forest Sciences Centre of Catalonia while holding a Victoria Fellowship. Before that, Luke's position was supported by the ARC Centre of Excellence for Environmental Decisions. Luke completed his PhD at Deakin University in 2011, where he studied the distribution, ecology and conservation of small mammals in the 'mallee.' He still loves working on mammals.



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

Evolutionary Transformations in Vertebrate History

2 – 4th October, Melbourne Museum



This **Boden Conference** is a two-and-a-half-day symposium, bringing together top Australian and international scientists, students, and early career researchers to present the latest advancements in investigating the evolutionary dynamics of these profound events, with an emphasis on methods for integrating modern and palaeontological data.

Evolutionary transformations during the 500-million year history of vertebrate life include the colonisation of land by tetrapods, the secondary invasion of water by whales, feathered flight in dinosaurs, and live mammalian birth, to name but a few. These shifts involve fundamental changes in ecology, behaviour, physiology and development that underlie the origins of major clades and have lasting consequences in modern vertebrate forms.

The conference will end on Friday evening, 4 October, with a catered social event held at the **Royal Society of Victoria**, where esteemed Australian palaeontologist **Professor John Long** will give an informal talk on the significance of Australia's fossil record in reconstructing the history of vertebrate life.

Keynote Speakers:

Professor Michael Coates, University of Chicago, USA
All change? The Devonian-Carboniferous boundary and the origin of modern vertebrate clades

Assistant Professor Graham Slater, University of Chicago, USA
Paleo-phylogenetic perspectives on morphological and ecological diversification in Cetacea

Dr. Daniel Thomas, Massey University, NZ
Towards resolving an adaptive landscape for penguins

Dr. Emma Sherratt, University of Adelaide, Australia
Reconstructing morphological evolution from complex phenotypes and Big Data

Professor Anjali Goswami, NHM/University College London, UK
From development to deep time: the consequences of phenotypic integration for vertebrate evolution

Dr. H el ene Morlon, CNRS, France
Phylogenetic approaches for understanding how biodiversity is distributed in space and time



Registrations: \$220 standard, \$200 RSV members, \$190
student/concession. Register online now at
<https://rsv.org.au/events/evolutionary-transformation/>.

Nominations for RSV Membership

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

Professor Rodney Daniel **SINCLAIR**, Professor of Dermatology, The University of Melbourne

Mr Guy **HODGKINSON**, Technical Director, Middleton Group

Ms Vanessa **WILLIAMS**, Strategic Communications, Jesuit Social Services

Mr Mark **BARTOLI**, Director, ATEC Solutions

Mr Sheik Mohammed Ali **SHAJAHAN**, Postgraduate Researcher, RMIT University

Professor Jude **EDIAE**, Founder/CEO, Global Youth Mental Health Awareness Limited

Associate Professor Elisa Llewellyn **HILL**, Neuroscientist, RMIT University

Professor Ashley **FRANKS**, Microbiologist, La Trobe University

Mr Shane **RAMAGE**, Licensed Surveyor, Surveyor General of Victoria

Mr Colin James **HALL**, Senior Surveyor, Surveyor General of Victoria

Professor Emeritus Frances **SEPAROVIC**, Biophysical Chemist, The University of Melbourne

Dr Alison **COMPTON**, Postdoctoral Fellow, Murdoch Children's Research Institute

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 10th October 2019. Recently elected members who have not yet signed the Society's membership book are warmly invited to attend the 12th September meeting to be formally welcomed as members. **Please inform the office if you plan to attend, so we can prepare your membership certificate and welcome pack for collection.**

From the President

How did you enjoy and survive Science Week?

I was overwhelmed by **Dr Renee Beale** (RSV's Science Week Monarch – sorry, I mean Lead) - when she told me that there more than 440 events being held in Victoria. Renee and a vast team of people across

Victoria organised spectacular events for people of all ages.

Each event was different and opened the eyes of participants to how significant science is in their everyday life. I looked on in amazement as people of all ages participated and enjoyed such an extensive array of hands on activities.



My personal favourite was the Extrasensory program at Parliament House where about 1200 people participated in more than 40 hands on event over 4 hours. For many people it was a doubly special event as it was their first visit to Parliament House. What a wonderful night. More reports elsewhere in this newsletter.

Come and have a cuppa with me

I'm pleased to invite all our members to come and have a cuppa with me to discuss any RSV issues. I'll provide the tea/coffee and some light refreshments... you provide your questions and thoughts about any of our activities. The schedule of these meetings is as follows:

- Monday 9 September 2-4pm
- Tuesday 10 September 11am – 1 pm
- Wednesday 11 September 10am - 12pm
- Thursday 12 September 2-4pm
- Friday 13 September 10 am -12pm

To help with catering it would be appreciated if you could book on the form that has been emailed to all Members. If you didn't receive the email or would like to suggest another time, please send me a note at president@rsv.org.au or call me on 0418 346 999.

Looking forward to meeting you soon.

- **David Zerman**

The Young Scientist Research Prizes – 2019 Competition Results



From left: Dr Rachel Brand, Ms Avanthi Isaka Badulla Liyanage, Miss Shruti Nirantar, Ms Elvina Parlindungan, Ms Annie Cox, Ms Emily Roycroft

We enjoyed another remarkable, whirlwind tour of the sciences at the Society on Thursday, 16th August, with six outstanding early-career scientists presenting work that pushes the boundaries of knowledge across incredibly diverse fields of research.

The applicant pool grew this year to 60 final year PhDs from across Victorian research institutions, meaning our six finalists had already distinguished themselves simply by being selected to present to us on the evening.



Judges gotta judge! RSV Councillors, Trustees and guests in the Cudmore Library.

Our six finalists were selected on the quality of their written applications and their scientific work. On the big night, the daunting task for a finalist is to somehow distil the methods and significance of their complex work to a general audience of scientists and science enthusiasts in a clear, concise, accessible and engaging presentation of no more than 10 minutes. 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. We convey our sincere thanks to all finalists for their commendable efforts, particularly to those facing the challenging final months of their doctoral studies.



RSV Science Program Chair, Dr Kevin Orrman-Rossiter

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

Physical Sciences

First Place:

Avanthi Isaka Badulla Liyanage

Department of Civil Engineering, Monash University



Avanthi Badulla Liyanage presenting to the Society.

“Application of supercritical carbon dioxide in enhanced geothermal systems.”

Global energy demands are such that we need to increase our energy production by 30% by 2040. To keep up with the demand, we need to look to renewable energy sources.

A large area of the Australian continent is under-laid by hot rocks (greater than 200°C), and if we exploit even 1% of it to create geothermal energy, then Australia would have over 25,000 years’ worth of energy supply.

Current deep geothermal systems use eight Olympic size swimming pools’ worth of water in one go, so Avanthi is devising a method of using liquefied carbon dioxide instead. This would remove CO² from the atmosphere as a greenhouse gas as well as inducing multiple fractures when injected into the ground to collect heat from the rocks on its way back up.



Ms Avanthi Isaka Badulla Liyanage with RSV President David Zerman.

Second Place:

Shruti Nirantar

School of Engineering, RMIT University

“Electronics beyond silicon: Switchable nanoelectronic devices.”

Silicon transistors are the base of our technological devices, but we are reaching the limits of the computing power we can generate with it. Shruti is investigating alternatives that can keep up with our demand for digital data and increasingly fast, powerful, and smart technology.

Current transistors waste energy as the electrical current within is scattered, and she is designing transistors that force the current to travel in a straight line rather than be diverted.



Ms Shruti Nirantar presenting to the Society.

A vacuum would solve the problem, but would be costly and bulky to manufacture. She is therefore reducing the distance the current has to travel by making transistors with tungsten, gold and platinum. She is also developing “memristors”, which saves data in the form of resistance states based on how our human brains would do it. Her idea is to have less leakage in terms of current, high storage capacity for data, and faster speeds.



Ms Shruti Nirantar with RSV President David Zerman.

Biological (non-human) Sciences

First Place:

Emily Roycroft

School of BioSciences, The University of Melbourne & Museums Victoria

“Phylogenomics, adaptation and extinction in the evolution of native rodents.”

Australia has the worst rate of mammal extinctions worldwide. 30 Australian mammals have become extinct since 1788 and all that remains of them are in museum collections.



Ms Emily Roycroft presenting to the Society.

With new technologies that allow us to obtain and sequence DNA from these old specimens, Emily is investigating the insights that genomes give us to past and present biodiversity within native Australian rodent species. She collected 300 specimens and sequenced their DNA to create a phylogenetic tree (determining their relationships) and saw that there was a link between larger size and extinction – possibly due to predation by introduced species.

She also compared the genetic diversity of closely related species to determine that territorial ranges and genetic diversity have been more dramatically reduced in just the past 200 years than previously realised, meaning some remnant species require a dramatic rethink of management status from “threatened” to “endangered.”



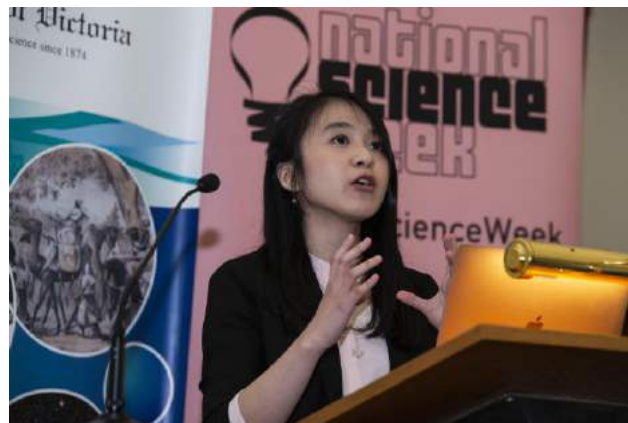
Ms Emily Roycroft (and son) with RSV President David Zerman.

Second Place:

Elvina Parlindungan

School of Science, RMIT University

“Developing new antimicrobial compounds from bacteria to improve food safety and reduce food waste.”



Miss Elvina Parlindungan presenting to the Society.

One third of the food produced in the world goes to waste at a cost of approximately \$940 billion USD. Microbial contamination of food leading to food spoilage is a large contributor to this waste.

Elvina is producing a natural bio-preservative using “good bacteria”. *Lactobacillus plantarum* is a bacterium that produces antimicrobial peptides, which can hinder the growth of bacteria that spoil food.



Miss Elvina Parlindungan with RSV President David Zerman.

She has developed a way of “starving” the bacteria to maintain their antimicrobial properties under the harsh conditions of food production and storage (i.e. being stored for weeks at different temperatures). These starved bacteria can kill spoilage and pathogenic bacteria species when

challenged, and she therefore hopes to use this work to improve food safety and reduce food waste.

Biomedical & Health Sciences

First Place:

Annie Cox

The Ritchie Centre, Department of Obstetrics and Gynaecology, Monash University



Ms Annie Cox presenting to the Society.

“Protecting women with preeclampsia and their babies: Could sulforaphane, a broccoli sprout extract, be the answer?”

Pre-eclampsia can cause circulation problems during pregnancy, affecting the blood supply to the placenta and limiting the baby’s supply of nutrients and oxygen. Some of the effects of pre-eclampsia are inflammation, high blood pressure, oxidative stress, blood vessel damage, and hypoxia (low oxygen levels). Typically the high blood pressure is addressed while other side effects are not, and the placenta is removed and the baby taken out early.



Ms Annie Cox with RSV President David Zerman.

Given that oxidative stress is one of the drivers of tissue damage in pre-eclampsia, Annie wondered whether anti-oxidants might be an answer. She has tested the ability of sulforaphane, an anti-oxidant found in broccoli, to restore placental blood vessel health and function *in vitro*, and is now investigating it as a treatment and prophylactic in protecting pregnant women and their babies.

Second Place:

Rachel Brand

Centre for Mental Health, Swinburne University of Technology

“Trauma, post-traumatic stress symptoms and voice-hearing: An exploration of causal mechanisms and potential treatment approaches.”



Dr Rachel Brand presenting to the Society.

The voices a schizophrenic patient might hear could be threatening, critical or commanding. Every patient experiences these auditory hallucinations differently. But there are no good theories as to why auditory hallucinations are associated with psychotic disorders, and treatments are lacking.



Dr Rachel Brand with RSV President David Zerman.

Rachel worked with patients and began to notice a pattern: that the voices are often a replay of things people have heard before in their lives. She hypothesised that these are a type of trauma memory intrusion as seen with Post Traumatic Stress Disorder (PTSD).

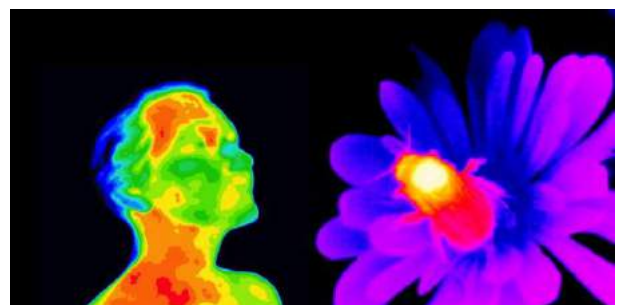
Rachel began assessing the association between traumatic memory intrusions and the occurrence of hearing voices and found that they were frequently linked. Now she is pioneering the use of PTSD trauma therapies for auditory hallucinations, resulting in a reduction of voices heard by many patients.

Thanks to all applicants, our finalists, our assessors and judges, and the many friends, family members and colleagues who came out on the night to support our finalists, including some familiar faces from our competition's earlier years! Some photos from the evening are provided below, and online from our web site and Facebook page.



One, Two, BEE

by Catriona Nguyen-Robertson MRSV



*This article follows a presentation to the Royal Society of Victoria on 23 May 2019 titled "Are bees smart pollinators? You can count on it!" featuring vision scientist Associate Professor **Adrian Dyer** from RMIT University.*

One third of the world's food production depends on bees – they are the world's most important pollinator. Effective pollination by bees increases yield and improves the quality of agricultural produce, increases their resistance to pests, and preserves ecological balance and biodiversity in nature. The United Nations declared the 20th of May as World Bee Day to remind people of the importance of bees, and the Royal Society of Victoria hosted a lecture in their honour.



Associate Professor Dyer presenting to the Society.

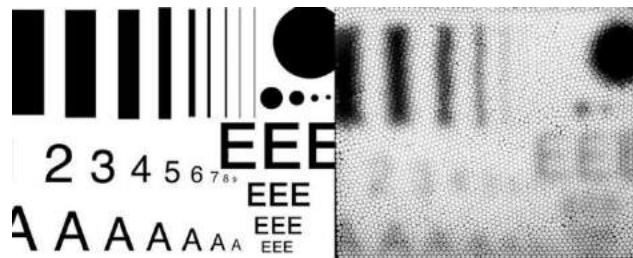
Bees are more intelligent than you might think. Associate Professor Adrian Dyer is interested in how the miniature brain of a bee can perform complex cognitive thinking. As a vision scientist and photographer, he seeks to understand how the representation of an image is created. In school, he was encouraged to pursue maths and arts by his teachers, and so he decided to study a bit of both in photography. Now he uses science as a way of problem solving and investigating visual perception at the RMIT School of Media and Communication.

While we may now take it for granted that other animals see colour, up until the last century, colour was only believed to be an aspect of human perception alone. The brains of bees are comprised of 960,000 neurons and are the size of a sesame seed. The human brain is 20,000 times bigger, and therefore insects were thought to have constrained neural processing capabilities in comparison. But 100 years ago, Nobel Laureate, Karl von Frisch changed this mindset: he showed that bees indeed have colour vision by training honeybees to collect a sucrose sugar solution associated with coloured cards, and they continued to return to the same coloured cards in the absence of

sucrose. Since then, we've learned that bees can even perceive ultraviolet wavelengths, which are beyond what we can see.

To study how honeybees learn, Dyer made use of their ability to distinguish and learn through colour. He built learning arenas adjacent to bee hives, in which each bee is individually numbered. Individual bees enter the learning arena where they are trained and tested with various tasks and they receive sucrose as a reward for learning.

How do bees find flowers to pollinate?



Sue Williams and Adrian Dyer – the comparison between the fine detail perceived by human (left) and bee (right) eyes.

The lens of a human eye focuses light onto the retina to perceive a sharp image, whereas bees have compound eyes that have many light-guiding tubes. Imagine looking through thousands of straws instead of looking clearly at an image. Sue Williams, Dyer's student built a "bee camera" to simulate how bees see.

You may wonder how they even find flowers despite their poor vision. The answer is in their different perception. In fact, beautiful flowers didn't evolve for our eyes, but for the eyes of bees and their pollinators.



Sue Williams and Adrian Dyer – an image of a yellow flower as it appears to us, taken with a UV camera, and then how it likely appears to a bee.

In a collaboration with botanist Dr Mani Shrestha, Dyer assess the colours emitted by flowering plants. Across the globe, even though different plant species evolved based on their drastically different environments, they all evolved their colour signals in parallel for their bird and bee pollinators. From Australia to Norway, and to the top of the

Himalayas (and Dr Shrestha had to trek up the mountains with his laboratory on his back to sample the data), all flowers provide colour signals similar light range. Dyer wondered how plants might differ in the absence of bees. The only place he found to answer this question was Macquarie Island in the Pacific Ocean, where no bee has ever been and the only pollinators are flies, which see different wavelengths of light – and the flower colour signals reflected this.

The cognitive ability of bees

Not only are bees able to perceive colour, but Dyer also trained them to discriminate between and recognise images of human faces. He also taught them to learn size relationships (bigger or smaller), which even machine vision can struggle with. For example, when you teach a child the difference between a big and small cup, if you point out two mountains, the child would probably recognise that one is a smaller mountain, even though it's bigger than the big cup.



Question time with RSV Vice-President Nicola Williams

Anyone who has seen honeycomb appreciates that bees understand geometry, but now they can even count and do arithmetic. Dyer has become a maths teacher for his bee pupils. He first recognised their mathematical ability when they recognised the concept of zero. When testing whether bees could determine which number was smaller of two (e.g. 5 or 2), they flew to the correct number. When he asked between 1 and nothing, the bees registered that nothing was smaller than one. This may seem trivial, but the mathematical zero and recognition of nothingness mathematically only appeared in the human record around 3 B.C. and reached Western Europe in the 12th century.

The next step was to determine whether bees can count and perform simple arithmetic. At first Dyer had no success, but perhaps he was going about it the wrong way. Mathematics uses a language that needs to be taught: “+” and “-” mean little to a bee. To bypass the communication issue, he used colours instead, with blue meaning “add one” and yellow meaning “subtract one”. When bees were put in a “maths maze” and asked to add or subtract shapes, they found the right path by correctly answering the questions and were rewarded with sucrose. This demonstrates the cognitive power of bees and their potential to learn.



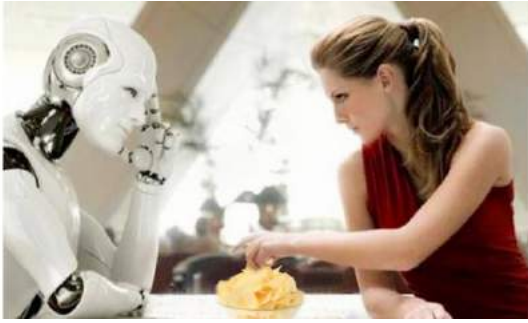
RSV Vice-President Nicola Williams (vote of thanks), Associate Professor Adrian Dyer, Dr Renee Beale, RSV President David Zerman

We're only just starting to understand how bees see the world. Dyer is employing the ability of bees to respond so well to colour to design more productive environments for agriculture that guide bees (effectively adding shopping aisle labels) so that they can better pollinate the crops. He also wants to mimic their biology in technology: 'Machines use a lot of energy to perform computational tasks. Our brains work on a sandwich. Bees can work on a single drop of nectar.' With increasing experience and understanding, there are many potential applications for this work, including robotics or building interfaces between sensors and biological systems.

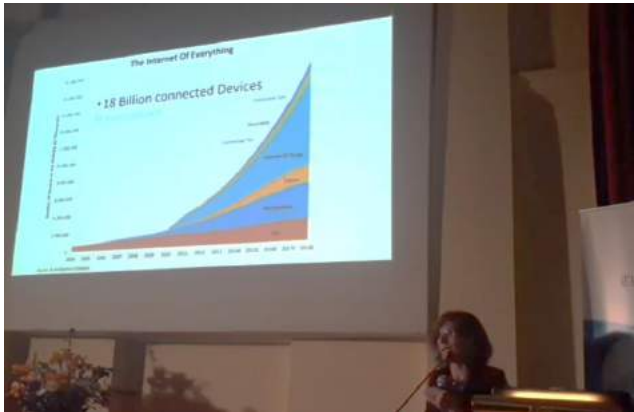
A livestream video recording of A/Professor Dyer's presentation can be viewed online at <https://www.facebook.com/royalsocietyvictoria/videos/vi.2282388202000129/447410709402465>

Humans and Robots

by **Catriona Nguyen-Robertson MRSV**



*This article follows a lecture to the Royal Society of Victoria on 25 July 2019 titled “Social Work: Collaborative Human–Robot Interaction,” featuring the Dean of Engineering at Monash University, Professor **Elizabeth Croft** and presented in partnership with the Victorian Division of the Australian Academy of Technology and Engineering.*



The Internet of Everything: we now live in a world with 18 billion connected devices

We are increasingly bringing more robots into our lives and they perform the duties that we assign them. But they remain separated from us - we have little interaction with them besides turning them on and off. Professor Elizabeth Croft is developing ways for humans and robots to live – as it were – harmoniously and work cooperatively.

When you picture a robot, you probably imagine the famous Hollywood humanoid characters, such as R2D2, Wall-E and Bender, but most robots are rather undramatic mechanical devices. They are programmed to perform the specific, repetitive tasks that we don't want to do – the boring, dirty, complex or dangerous tasks. We use robots in our everyday lives by using the self-checkout lane in a supermarket and in other ways, and robots are quickly moving

their way into assisted living, restaurants, production lines, medicine, crime fighting, and video surveillance for protection.

Linking robots with crime-fighting and surveillance is a concept seemingly taken out of science fiction. But Elizabeth made the connection years ago. After studying undergraduate mechanical engineering at the University of British Columbia, she worked in motor vehicle accident investigation – ‘it was CSI before CSI was cool’. She then wanted to explore robotics more in depth and undertook a master's degree at the University of Waterloo followed by a PhD at the University of Toronto.

With technology becoming more compact, smarter (with artificial intelligence) and having greater computing power, robots can now make decisions at fast speeds. The future of robotics is rapidly evolving. Elizabeth believes that robots are becoming more human-like and that we therefore need better, smoother human-robot interactions. “We need to think about how we're going to get along with the robots,” she says, after all, they are already increasingly coming into our homes.

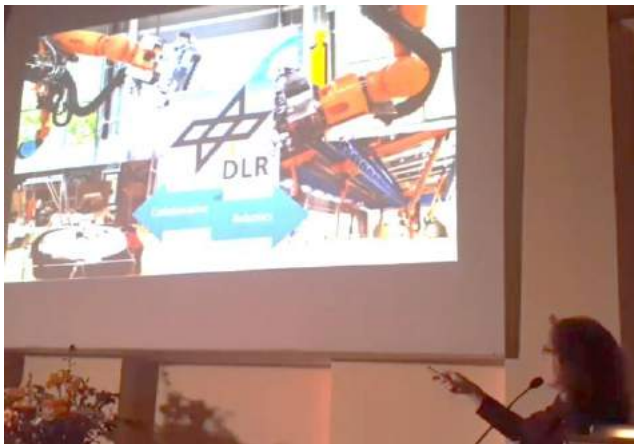
Elizabeth wants to make sure that people are considered in the design of robots. In all of her designs, she starts by first observing people.



The first human-robot interaction she studied was the passing of objects. She watched people passing objects between themselves over and over. She monitored the grip force at the point of passing and learned a simple rule: the giver is responsible for the object's safety and the receiver is in charge of maintaining efficiency (i.e. the giver ensures it doesn't fall while the receiver controls how quickly the object is taken). Once she

understood the rule, she could encode robots to follow it. This enabled robots to pass objects in a fluid motion without dropping the object or requiring the receiver to yank, which is an important skill for service and medical robots.

She performed a similar study when considering how humans and robots may reach for objects at the same time as they work together. If you reach a doorway at the same time as another person, for example, often you will both briefly pause to establish who will walk through first. Robots did not have this consideration. After observing people, determining rules, and encoding robots to read social cues when sharing objects and space with people, Elizabeth found that humans were much happier to interact with them.



Robots are also being increasingly used in industrial production and assembly lines. Elizabeth taught them to work together with people to sort shapes. She asked people to complete shape-sorting tasks in pairs in silence, and mimicked their actions for “I’m done”, “move that”, “place here”. This has since been implemented in manufacturing processes that require teamwork between robots and humans.

Lastly, Elizabeth envisages delivery mail-bots that share our footpaths in the future. This may be tricky, however, as the robots have to navigate around pedestrians. Elizabeth programmed robots to follow people walking around, taking in their knack of cutting corners and meandering rather than travelling in straight lines. Eventually the robots started to move in a more socially acceptable manner and reached their

destinations faster as they learned to cut corners just as people do.

To ensure that the future is robot-friendly, Elizabeth encourages engineers and programmers to focus on people in their design. At the back of her mind, she constantly thinks of designing technology that her mother would be able to use. Robots can ‘learn by watching a human teacher’ if the behaviours are broken down into something codeable. So, let’s keep humans in the loop as we bring more robots into our lives!



RSV Treasurer Andrew Davison (vote of thanks) with Professor Elizabeth Croft and Professor Alexander Gosling AM, Chair of the Victorian Committee for the Australian Academy of Technology & Engineering.

Extrasensory

by Catriona Nguyen-Robertson MRSV





Everyone's reality is slightly different. We all experience the world around us in different ways. Our world is sensed as numbers and electrical impulses that our brains then turn into something meaningful. At Extrasensory, everyone was challenged to make sense of the world of the senses and find the limits to their own.



There were many incredible sights, tastes and sensations to behold. Skunk Control (Victoria University) displayed their Fractured Alter light installation. A display of transparent and white flowers made from treated plastics may have seemed simple, but through a polarised filter, the white light was transformed into a burst of colour.

People also looked up at the stars with Dr Simon Cropper (University of Melbourne's

School of Psychology) to find patterns and stories in the sky. What you find can tell you something about your mind. There were also virtual reality (VR) experiences hosted by Swinburne University, CSIRO Data61 and the ARC Centre of Excellence in Convergent Bio-Nano Science and Technology. Participants took the virtual balance challenge, travelled through the digestive system, and explored the inside of a cell.

For those whose sense of sight isn't as strong, there were tactile displays and activities. In what looked like an arts and crafts explosion, the Rossjohn Infection and Immunity Lab at Monash Biomedicine Discovery Institute produced a vibrant display of molecules, cells and pathogens made from food and craft materials. Their idea was to immerse the low vision and blind community in the immune system by allowing them to touch large models with the fine details. SensiLab (Monash University) challenged people to navigate their way with tactile maps, and people soon realised that images that work well for a visual map (e.g. a knife and fork representing dining areas) don't necessarily work as well by the sense of touch.



Rossjohn Lab put together a vibrant, tactile display for the blind and low vision community to learn about molecules, cells and microbes.

There were also delectable tasting sensations on offer. Emma Donnelly (Culinary Science) and Jon Seltin (Brick Lane Brewery) held workshops on the science of champagne and beer – on how sparkling wine gets its bubbles, the best glassware to drink out of, and the aromatic compounds

that are added to beer. Participants were also tricked by food scientist, Tara Storey, into believing that some chocolate was sweeter than others based on the music they listening to while tasting. They also struggled to tell the difference between coffee and tea with eyes shut and nostrils clamped. Deakin University's Centre for Advanced Sensory Science also challenged participants to taste the fat in food and opened their eyes to the art of sensory marketing.



Would you wash your hands with soap made from sewerage waste? Science Gallery Melbourne set up a hand-washing station with soaps made from cooking oil waste, sewerage waste and palm oil.

The sounds of delightful music could be heard in Queen's Hall. Inspired by science, Elissa Goodrich, Adam Simmons and Gideon Brazil performed Gene Tree Project – music of the evolution of species. Vicki Hallett improvised riffs with her clarinets over the top of nature recordings in Elephant Trail. The last moments of the Mars Rover were captured in beautiful, haunting melodies on the piano by Sam Colcheedas.

Imagine being able to listen to a recording of that music and hear it as though it were live. Dr David Sly is designing the next generation of hearables, which includes headphones that provide 3D audio (the sound moves in relation to your head), amplification of sound as subtle, stigma-free hearing aids, and sensors that detect brain activity. Sound and visual cues were mixed by Arup to produce a sound lab experience that messed with the mind. By playing monosyllabic sounds and watching people's lips, your brain can be tricked into hearing what it's lip-reading. People also walked through sound in Sonic

Efforts; walking is something we don't think about, but Frank Feltham (RMIT) devised a system increases awareness of your pressure and balance when moving by listening to sound.



Stu Favilla at Swinburne University's "hearables" station

In the Legislative Council and Assembly Chambers, speakers presented on a plethora of engaging topics. Susie Sheldrick from Silverpond spoke of the use of artificial intelligence (AI) to enhance our senses: Computer vision has allowed us to interpret images rapidly (e.g. cameras that can diagnose medical conditions), provide a sense of touch to prosthetics, and E-noses that recognise chemicals.



Susie Sheldrick from Silverpond in the Legislative Council, discussing the enhancement and extension of human senses through artificial intelligence and assistive devices.

NASA geobiologist, Dr Darlene Lim is working in simulated space missions on Earth to determine how astronauts will best conduct science and interact with an environment they'll never be able to experience with their own senses. It's unfeasible to ever touch rocks on the Moon or Mars with our bare hands, but her team is working on building communication

strategies and simulations, so that humanity can make the most of the rest of the Universe. Dr Kate Selway's expeditions, on the other hand, are in "a world that is totally white and featureless". She spoke of her travels at the ends of the Earth, where senses can become useless when camping at the North or South Pole.



Dr Darlene Lim in the Legislative Assembly

We have a selective attention, according to Dr Luke Simillie. When we focus on one thing, we can miss something else. Yet at other times, as Dr Simon Cropper pointed out, we can be a slave to the senses. We all have different realities and experiences in the world, and for some people they receive more information than normal, leading to hallucinations and synaesthesia. Dr David Farmer was certainly concerned about an information overload when he introduced himself for his *Intrasensory* science comedy – sometimes it can be too much for the mind to cope.



Is Dr David Farmer a Doctor, a Farmer or a Neuroscientist? He's basically asking too much of people during introductions and should be thoroughly ashamed of himself.

"There is no objective truth when it comes to vision," Dr Maddy Yewers says. Humans have three photoreceptors for colour, while dogs have only two and can't see red. Other

animals, such as bees, manta shrimp and the tawny dragon lizard, can have more and see ultraviolet light too. Dr Enrich Fitzgerald has studied whales' senses: blue whales produce low frequency sounds in the infrasonic spectrum, which allows them to detect coastlines but not small objects, while other whales have high frequency sound for the echolocation of small objects (like their food).

Professor Arun Ram listens to classical music and associates it with mathematics. Musicians and mathematicians share similar emotions and precision, and so he spoke of the empathy of maths and music. To him, Einstein and Holst took similar paths to create their masterpieces. Dr David Sly is more interested in how we hear the music and is developing the next generation of hearable technology. Not only is he looking to improve sound quality with 3D audio, but smart assistance and sensors can be added to devices to provide stigma-free hearing aids, brain monitoring for seizures, and more.



Professor Arun Ram in the Legislative Assembly

We feel, see, hear, smell, and taste the world, and we use balance, proprioception and other senses to centre ourselves in it. *Extrasensory* was an exploration of our experiences – to challenge ourselves, learn which inputs influence the other, and figure out where our senses are heading with advancing technology. The way we experience the world is changing, and now and then, it might just trick you.

Thanks to our amazing colleagues at the Parliament of Victoria for a wonderful evening – video highlights are available from <https://www.facebook.com/VicParliament/videos/375765723107095/UzpfSTlwMTY2Mjk0MzMyODMyMDoxMjMzMDEzMjAzNTI2NjE3/>

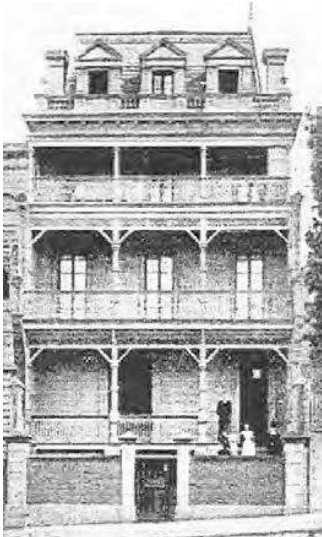
Celebrating 130 years of women at the Royal Society of Victoria

About Nellie Neild

The Society's first female member, Helen Harriet Neild
(1859 – 1907)

Registered as an Ordinary Member of the Royal Society of Victoria on 10th
October, 1889

by Mike Flattley, CEO



'Bilton House,' 21 Spring Street, Melbourne

Helen Harriet Neild was born to Ms Susannah Long and Dr James Edward Neild in Melbourne, 1859.

The family resided at 'Bilton House,' 21 Spring Street, opposite a swampy tract of land deemed unsuitable for building that was to become the Treasury Gardens over the course of the nineteenth century. It was the year the former Philosophical Institute of Victoria received its Royal Assent to become the Royal Society of Victoria, and the year the Society took possession of its freshly-constructed Hall.



Nellie's father: Dr James E. Neild M.D.

The Melbourne of the 19th century was a male-dominated world, and the context of Nellie's life was provided by the activities of her father James. He was a well-educated English surgeon and an enthusiastic patron of the arts, who had immigrated to Australia during the early years of the gold rush, eventually settling in Melbourne in the mid-1850s to join the family of David Rutter Long (his future wife Susannah's father) in establishing



Long & Neild, a pharmaceutical business. He was also one of the earliest members of the general reporting staff at *The Age*, and later took on the theatrical pages of the *Examiner*, the *Australasian* and *The Argus*, where he courted sustained controversy through his withering reviews of Melbourne's early theatrical events, to apparent personal relish. (Gandevia, 1974) His biographer Harold Love suggests Dr Neild was no stranger to extra-marital affairs; whether these were conducted purely through the deployment of charm within an acceptable code of the era, exploitation of his status as a feared theatre critic, or manipulation of his position as a leading medical authority, is open to conjecture. (Love, 1989) As with some other very colourful figures in the surgical scene of colonial Victoria, his character is incisive, agitated, dominant, opinionated and sometimes discomfiting.



Program of combined 'Grand Complimentary Concert' held at the Melbourne Town Hall and 'Special Dramatic Matinee' held at the Princess Theatre, 19 July and 26 July 1890 respectively, in honour of Dr James E. Neild. Pasted into J. E. Neild Scrapbook, c.1874-1948, MS 13557, MS Box 4011, Australian Manuscripts Collection, State Library of Victoria.

Nonetheless, Dr Neild was an accomplished man. He was appointed a lecturer in forensic medicine at the

University of Melbourne in 1865, co-founded the Victorian branch of the British Medical Association in 1879 and also the St John Ambulance Association in Australia. He was the first president of the Victorian Eye and Ear Hospital.

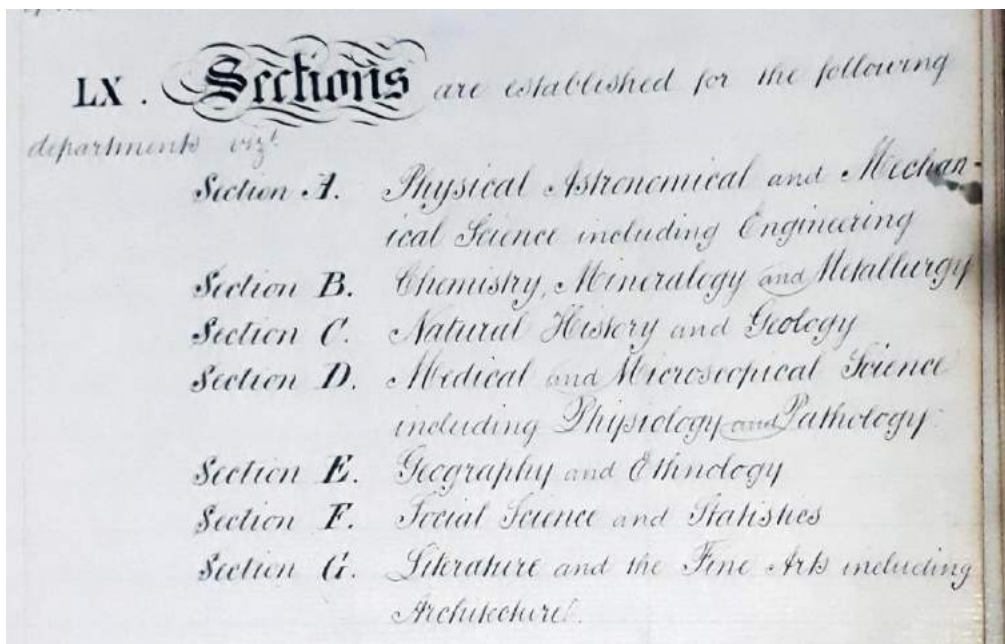
During Nellie's childhood and early adulthood, James was a leading member of several influential Melbourne society groups, generally reflecting his passion for both high literature and professional writing. He was a foundational member of the Yorick Club, a gentleman's club concerned with the arts and sciences that included author Marcus Clarke (first cousin of one of the Society's founders, Captain Andrew Clarke), Adam Lindsay Gordon, J. J. Shillinglaw and George Arthur Walstab (the Yorick Club eventually merged with the extant Savage Club in 1966). He was also a co-founder of the Melbourne Shakespeare Society (president in 1890).



Dr James Edward Neild M.D. signed into the Royal Society of Victoria's register of

members on **25 June, 1860**, shortly after his daughter Nellie's first birthday. He acted over the period stretching from 1860 through to 1890 as the Honorary Librarian for the RSV (and also the Medical Society of Victoria), a key role concerned with building the scientific knowledge base available to scholars of the Colony of Victoria through publication of the RSV's *Proceedings* and *Transactions* for exchange with learned societies around the world, an attempt to corral the 19th century's global scientific knowledge within a small building of the newfound City of Melbourne.

Section G – Literature and Fine Arts



The Society's original rule 60 (LX) provides the context of Dr Neild's proposal for Section G

Early in 1889, Dr Neild addressed the Society "on Literature and the Fine Arts." He considered that, given the initial Laws of the Society declared:

that the institution was founded for the advancement of Science, Literature, and Art, it is at least remarkable, that, hitherto, the operations of the Society have been almost exclusively confined to the consideration of the first of these subjects.

In Law 53, it will be observed, provision is made for departmental work, this being defined in an enumeration of eight sections, all of them, however, curiously enough, having reference to Science, except Section G, which, as I

have intimated, deals with "Literature and the Fine Arts, including Architecture. I am quite sure it is not because these subjects have been considered of subordinate importance that they have not been dealt with, neither has it been supposed, I think, that in a new country such as this, the belles lettres are incongruous or premature. It is possible that it may have been deemed unnecessary to take them into consideration, in the belief that societies exist here, having a special mission to concern themselves with Art and Literature. In any case, it is a cause of regret that Section G has, up to the present, never been developed. I should very much like, therefore, to assist in developing Section G. (Meetings of the Royal Society 1889, 1890)



Miss Helen "Nellie" Neild BA



Julia Margaret Guerin, 1883

The second child and eldest daughter of eleven siblings in the Neild household, Nellie had been brought up as a young society woman, notably singing at the Shakespeare Society's musical gatherings in the late 1880s. With a gap of some years stretched between public schooling and the 'preliminary knowledge' required to sit a matriculation examination, Nellie would have been privately educated. She had attended the University of Melbourne to attain a science degree, which in those early years was offered as a Bachelor of Arts under Sir Frederick McCoy's guidance. She is identified by Dr Allan Madsley as a zoologist. (Madsley, 2013)

Born on 8 June 1859, Nellie was only slightly younger than, and would have attended the University around the same time as, **Miss Julia Margaret "Bella" Guerin (1858 – 1923)**, the first woman to graduate from an Australian university in December 1883, later attaining a Master of Arts in 1885. It is highly likely that Bella and Nellie were

contemporaries.

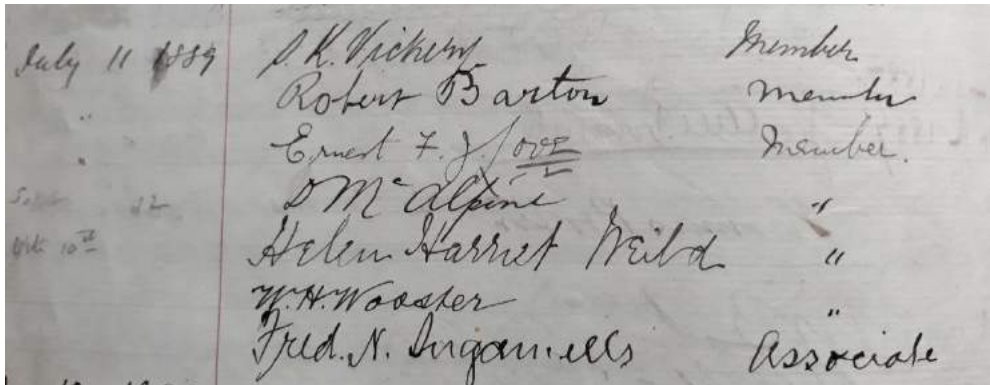
Ms Guerin was from a very different cultural background, the daughter of Irish immigrants, born in Williamstown in 1858. Her father Patrick was a penal sergeant and later governor of gaols in Melbourne, and her mother had instructed Bella at home in order to pass matriculation. The remarkable Bella became a fervent advocate for girls' higher education, a leader of schools, a proponent of universal suffrage and later a leader of the women's movement within the Labor and Victorian Socialist parties. (Farley, 1983)

Nellie had a very privileged upbringing for colonial Melbourne, raised in a different cultural caste altogether. Her father was an acknowledged conservative and his daughter's politics were likely to have been far less progressive than that of the fearsome Bella and her family. However, she plainly had the courage to challenge the status quo within the male-only Royal Society of Victoria, which was very much comprised of the Colony's establishment figures. She was perhaps emboldened by the pioneering work of her fellow female students at the University of Melbourne. Her father was clearly a vigorous champion of his daughter in the endeavour, and Nellie's involvement in Melbourne's theatre and literature scene through her family would have made the (short-lived) resurgence of "Section G" a suitable catalyst for preparing the application.

Miss Helen H. Neild was nominated as a member of the Society at the meeting of **Thursday, 11th July, 1889**. The minutes read as follow:

Transactions

Regarding the nomination of Miss Helen H. Neild, the PRESIDENT said that the proposal of a lady as a Member of the Society, marked an era in its history. After careful search through the Laws, the Council could find nothing to prevent a lady becoming a Member of the Society. He believed the Society was formed on the supposition that ladies as well as gentlemen would become Members of it. The ladies had not hitherto come forward to claim their right, but it was not improbable that many others would follow the example set by Miss Helen H. Neild. The particular circumstance that led to the nomination under notice, was the establishment of Section G – Literature and Art. In that Section, ladies would probably take a particular interest. (Meetings of the Royal Society 1889, 1890)



While an earlier account of Helen Harriet Neild's election to the Royal Society of Victoria attributes the election date to July, it was actually the meeting of **12th September, 1889** that elected her to the Society's membership as a simple matter of process. Meanwhile, the faint, pencilled date in our register of members records the **10th of October, 1889**, along with W.H. Wooster and Fred. N. Ingamells. Further, her father's account defines Helen as an Associate Member, while the register records her as a Member – this is borne out with the List of Members published with Vol. II (1889) of the Proceedings of the Royal Society of Victoria which lists Helen (with her father) as an Ordinary Member.

The minutes of the Society's *Proceedings* read:

Thursday, October 10th.

The President (Professor KERNOT) in the chair.

The minutes of the last Meeting were read and confirmed.

Miss H. H. Neild signed the book, and was introduced to the Meeting.

DR NEILD said: - Mr President and Gentlemen, I thank you for having elected my daughter as an Associate of this Society. She is the first lady Member, and her election marks an era in the existence of the Society, which has now been established for thirty-six years. I have heard some expressions of misgiving as to the propriety or expediency of introducing the female element into this Society. There is a fear that it might destroy its severely scientific character. I do not think the principal Members share those misgivings. In the present day, women are coming to the front in every direction, and I do not see why they should not, so long as they do not go to the extreme lengths recommended by the Women's Rights Association. So far as the intellectual position of women is concerned, I do not see why she should not take her position with us. I think we should welcome the advent of ladies into the Society, and I do not think any misfortune is likely to happen as the result, as we all know the particular reason of this influx is on account of the development of Section G – Literature and Art. I believe most of the ladies who intend to become Associates are attracted by

that Section. As Mr Way will inform you, we have had in our Shakespeare Society some most gratifying evidence of the advantage of including women among our members. We have had several ladies who have read very good papers, and they have from time to time taken part in the discussions. I am sure the effect of their presence at our meetings has been of a beneficial kind. I thank you very much for the honour you have done my daughter.

The PRESIDENT said the Council, at any rate, felt no misgivings as to the propriety of admitting ladies to the Society. This was evidenced by the fact that they all signed Miss Neild's nomination paper. It was hardly large enough to contain the names of the members of the Council. I certainly agree with Dr Neild that there is not the slightest reason why ladies should not be most useful members of the Society, not only of the literary, but of the scientific sections.

The PRESIDENT submitted a long list of names of ladies and gentlemen nominated for membership. (Meetings of the Royal Society 1889, 1890)

Notwithstanding some apparent confusion on her status as either an Associate or Ordinary Member, a Member she now was. She remains on the RSV's members' list – as an Ordinary Member – for a further year, then disappears forever. There was no notable rush to join by female members to remark upon – indeed, the Society appears to have returned to a male-only establishment in short order. In part, this might be attributable to Professor Baldwin Spencer's strong inclination from 1892 to do away with the "Sections" altogether, arguing that at roughly 150 members, the Society was far too small to sustain such a fragmentary program. It's notable that Dr James Neild ceased membership from 1896, ending a long membership of some 36 years. While perhaps the demise of "Section G" had soured Dr Neild's relationship with a Society he had earlier chastised as being "severely" focussed on science, it appears Dr Neild was spending his eighth decade in a period of intense professional industry; founding the St John Ambulance Association in Australia, and acting as coroner for a number of Victorian criminal cases, including the high-profile trial of serial killer Frederick Deeming. (Jones, 1981)



So who was Nellie Neild?

Little is known about Helen and her life – articles in *The Argus* are politely constrained to brief mentions of her performances at arts gatherings. However, we can deduce from some of the work attributed to her mother, Susannah, that she and many other women of "independent means" in the colony were instrumental in the various "ladies' associations" driving much of the organisation and fundraising work to enable new organisations such as the St John Ambulance Association to secure its first vehicles and commence operations.

Helen appears to have spent most of her life living in the family home with her parents and siblings at the grand residence at 21 Spring Street – in 1903 she is listed on the electoral rolls as living at this address with sister Beatrice Julia (architect, later governess), sister Caroline Emma (independent means), her father James (doctor), brother Joseph Masters (medical assistant, later wool sorter), sister Lillian Sarah (independent means), sister Myra Stella (independent means) and her mother Susannah (home duties). Another sister, Violet Alice (Edwards), had married and started a family, as had brothers Charles Melbourne (architect) and Edwin (journalist). Two further brothers died young: Albert Edward (1862) and William James (1879).

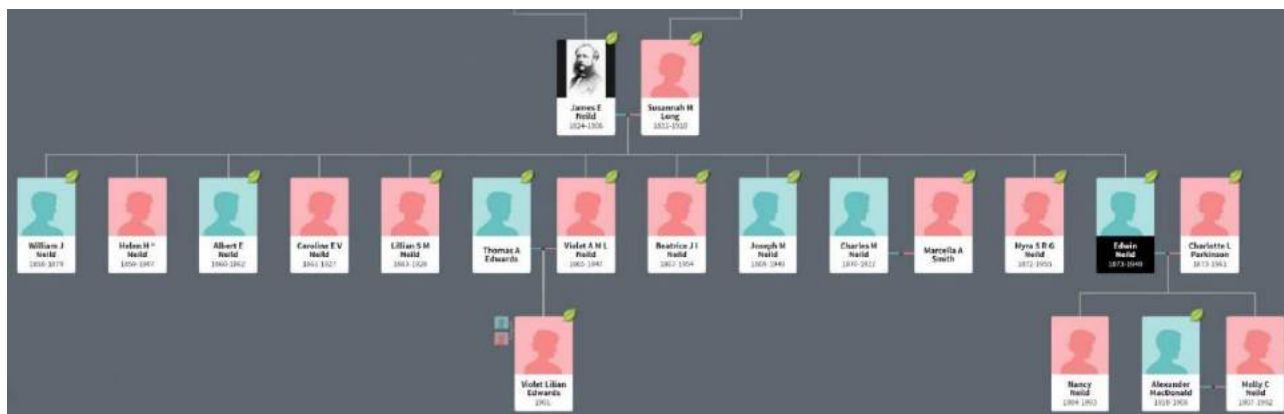


**Helen's mother,
Susannah Long,
c.1857**

Transactions

Following the death of her father James in 1906, the family moved to a new residence at 58 Canterbury Road, Middle Park. Nellie died the next year on 27th December, 1907, aged only 48. Her death certificate records the cause of death as “general nervous debility; pharyngitis; cerebral congestion - several months.”

For all the remarkable reproductive efforts of mother Susannah in producing 11 offspring, it appears there is only one line of the Neild family that has come down to the current day, with two known descendants currently living – these being the daughters of James’ and Susannah’s grand-daughter, Molly Neild (a nurse) and her husband Alexander Macdonald (a prominent trade unionist).



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NOTICE

A Commemorative Gathering for Female Members (and Guests) of the RSV

6:00pm, Thursday, 10th October, 2019

To commemorate 130 years of women as members of the Royal Society of Victoria, we will be inviting all female RSV members and their guests (men very welcome) to join us for a special gathering ahead of the evening’s lecture by **Dr Sapphire McMullan-Fisher**, a leading Victorian mycologist and one of the Society’s newest members.

Invitations will be sent directly to all fully-subscribed female members ahead of broader advertising to the RSV membership and the Victorian science community. **Please save the date** – we hope you can join us for a convivial evening of celebration, reflection and planning for growth in participation and leadership.

Videos of RSV Lectures and Events

Recent Transactions as of August 2019



Livestream video recordings of our lectures and presentations are streamed live via the RSV's **Facebook** site and archived in our "videos" section on conclusion. A selection of playlists are displayed below – these and others can be accessed from

<https://www.facebook.com/pg/roysocietyvictoria/videos/>.

2019 RSV Lectures

19 videos · Updated 3 minutes ago

Archived livestream video presentations at the Royal Society of Victoria.



The Alchemist: Turning Waste into Wealth

256 views · 17 August



Stories from the Cosmos - What Indigenous storytelling can teach...

703 views · 14 August



Mind over Faecal Matter: Gut Biome & Mental Health

241 views · 8 August

Science Gossip: Woodland Rumours & Thinking Trees

5 videos · Updated about 2 weeks ago

Livestream video and highlights from the Society's inaugural Science Gossip event on Wednesday, 15 May 2019.



Science Gossip: Woodland Rumours & Thinking Trees

151 views · 15 May



Science Gossip: Telling Digital Stories with Organic Materials

23 views · 15 May



Science Gossip: the Limits of Scientific Objectivity

46 views · 15 May

The Science of the Regional Forest Agreements

9 videos · Updated 38 seconds ago

The Royal Society of Victoria and the Department of Environment, Land, Water & Planning are partnering to deliver this series of talks concerning the... See more



The Conservation of Water & Soil Resources: Rne Van der Sant,...

134 views · 25 July



The Conservation of Water & Soil Resources: Rachel Brown, Tim...

141 views · 25 July



The Productivity of Forest Ecosystems - Dr Bill Jackson, Dr...

312 views · 21 May

YouTube Channel



High quality digests and long-form videos of recent RSV lectures are available from our YouTube channel - <http://tiny.cc/kx5q7y> will take you to the list below.



The Royal Society of Victoria

37 subscribers



Gamble, Drink, Consume, Repeat (Short)

The Royal Society of Victoria

10:00



The Future of Electronics (Short)

The Royal Society of Victoria

8:15



The Marvels of Medicinal Plants (Short)

The Royal Society of Victoria

10:01



Fashionable Science (Short)

The Royal Society of Victoria

9:36

Modernisation of the Regional Forest Agreements

The Royal Society of Victoria and the Department of Environment, Land, Water & Planning (DELWP) are partnering to deliver this series of talks concerning the science underpinning the modernisation of Victoria's Regional Forest Agreements, addressing each of the criteria listed in the latest State of the Forests report, released this year by the Commissioner for Environmental Sustainability (<https://www.ces.vic.gov.au/articles/scientific-report-card-victoria%E2%80%99s-forests>). High quality video of proceedings has been produced by DELWP and are available from their Future Forests site at <https://www2.delwp.vic.gov.au/futureforests/forest-values-assessment/public-lecture-series> - footage currently online incorporates the first two of the three public lectures convened thus far.



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Donations to the Royal Society of Victoria can be made at any time via the following methods:

Online: we can accept contributions through credit card and PayPal transactions on our website at <https://rsv.org.au/about-us/support/>

Via mail: the form **below** can assist you in allocating your donation to your preferred activity area, using either your credit card details (Visa or Mastercard), a cheque/money order made out to the Royal Society of Victoria, or notification of a direct Electronic Funds Transfer (EFT) transaction to the Society's bank account.

In person: we can accept donations at the Society's office in cash, cheque/money order or via credit card.

Donation Form

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Support the Royal Society of Victoria

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Please detach this page and return with your preferred payment method to: The Royal Society of Victoria, 8 La Trobe Street, Melbourne, VIC 3000. ABN: 62 145 872 663. Grateful thanks for your generous support for our many endeavours!

We will provide a tax receipt for all donations received over \$2.