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…

13th December:

"Medical Bionics & Visualising Immunity"
RSV Research Medallists' presentations and annual dinner

Professors Jamie Rossjohn & Anthony Burkitt

20th December:

"The Science in Modernising the Regional Forest Agreements"
Featuring: ***Dr Rebecca Ford, Dr Lindy Lumsden, Dr Graeme Newell, Associate Professor Craig Nitschke***

Presented with DELWP's Fire, Forest and Regions Group

February 2019 Advance Notice

1st and 8th February: RSV Members' Conference

December 2018 Newsletter

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The Royal Society of Victoria Inc.
8 La Trobe Street,
Melbourne Victoria 3000
Tel. (03) 9663 5259
rsv.org.au

14th February:

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

28th February: Panel Presentations & Discussion

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

Medical Bionics & Visualising Immunity

The RSV Medallists for Research Excellence: Presentations & Annual Dinner

Thursday, 13th December 2018 at 6:30pm

Speakers:

Professor Anthony Burkitt

Chair in Bio-Signals & Bio-Systems, Department of Biomedical Engineering
Melbourne School of Engineering, The University of Melbourne

Professor Jamie Rossjohn

ARC Australian Laureate Fellow and Head of Infection & Immunity Program
Monash Biomedicine Discovery Institute, Monash University

Two high achieving Medallists, two great talks! Come learn about the outstanding work of this year's recipients of the RSV Medal for Excellence in Scientific Research, who will be presented with their Medals by **Her Excellency the Governor of Victoria** ahead of the public presentations.

Visualising Immunity: Up Close and Personal

Following on from Leeuwenhoek's development of the microscope in the 17th century, scientists over the ensuing decades have been able to look into the world of microbes and cells. **Professor Jamie Rossjohn**'s laboratory uses a very powerful "microscope", namely the Australian Synchrotron, to visualise immunity.

The immune system is vital for our survival. It protects us from pathogens, such as Influenza. Sometimes the immune system goes wrong, and causes disease, including autoimmunity and allergies. Professor Rossjohn's laboratory has provided insight into the function and dysfunction underpinning the human immune system, and he will touch upon these findings.

Medical Bionics and the Quest to Restore Hearing and Sight

Medical bionics offers the possibility to people with profound sensory impairments, such as blindness and deafness, for the restoration of these faculties. This can lead to an improved quality of life for patients with degenerative neural conditions that arise through disease, accident or genetics.

Recent developments in medical bionics and the challenges associated with providing clinically safe and commercially competitive technologies to provide functional everyday benefits to patients will be presented by **Professor Anthony Burkitt.** These issues will be illustrated by the Bionic Vision Australia research program, which has developed a fully implantable retinal prosthesis, based upon a successful prototype study with three patients.

About the speakers:

Professor Anthony Burkitt holds the Chair in Bio-Signals and Bio-Systems in the Department of Biomedical Engineering at the University of Melbourne since 2007. His research encompasses a number of areas of medical bionics and neuroscience, including neuroengineering, computational neuroscience, retinal-implant vision processing, cochlear-implant speech processing and bio-signal processing for epilepsy. His research has made significant contributions to understanding the behaviour and function of the brain and it has also been instrumental in the development of visual stimulation paradigms for retinal implants, new cochlear implant speech processing strategies, methods for detecting and predicting seizures, and the use of electrical stimulation for seizure abatement in epilepsy.

He was the Director of Bionic Vision Australia (2010-2016), a Special Research Initiative in Bionic Vision Science and Technology of the Australian Research Council (ARC), and he successfully led the project though all of its phases: Project conception, securing $50million in ARC funding, the research and development programs that led to the development of a prototype bionic eye (suprachoroidal retinal implant), the successful implantation in three patients, and the establishment of the company Bionic Vision Technologies (BVT) with US$18million of venture capital for the ongoing commercial and clinical development of the technology.

Professor Jamie Rossjohn is known for his contributions to the understanding the molecular basis underpinning immunity. He has used structural biology to explain pre-T-cell receptor (TCR) self-association in T-cell development, and how the TCR specifically recognises polymorphic Human Leukocyte Antigen (HLA) molecules in the context of viral immunity and aberrant T-cell reactivity. He has unearthed structural mechanisms of HLA polymorphism impacting on drug and food hypersensitivities, as well as Natural Killer cell receptor recognition. He has pioneered our molecular understanding of lipid-based immunity by T cells, revealing that it can differ fundamentally from peptide-mediated adaptive immunity. Recently he has provided a structural basis of how vitamin B metabolites can be presented and recognised by the immune system, revealing a new class of antigen. Collectively, he has published more than 365 papers and mentored numerous researchers towards obtaining higher degrees and nationally competitive fellowships.

He is currently an ARC Australian Laureate Fellow (2017-2021) and was previously an NHMRC Australia Fellow (2011-2016) and ARC Federation Fellow (2007-11). He is the Head of the Infection and Immunity Program of the Monash Biomedicine Discovery Institute.

Medallists' Dinner

We are delighted to invite RSV members and their guests to attend the **2018 Medallists' Dinner**, our annual gathering to be hosted by the Society's President, Mr David Zerman in the Burke and Wills Room, following the talks from and presentations to Professor Rossjohn and Professor Burkitt.

Registrations for the dinner include admission to the lecture. Please join us for a convivial evening of celebration for science in Victoria and a reflection on the generative work of our Society in 2018. Tickets are inclusive of a three course, seated, plated meal with beverages.

Places limited, bookings essential! Register online now at https://rsv.org.au/events/2018-medal/, call or email the RSV office to secure your place: 9663 5259, rsv@rsv.org.au. **RSV Members** should check their emails, or call the RSV office to access their **discount code** for places at the lecture.

The Science in Modernising the Regional Forest Agreements

Thursday, 20th December from 1:30 – 5:00pm

Over the next four years, the Victorian Government will be partnering with Traditional Owners, and engaging with Victorian communities and stakeholders, to inform the modernisation of Victoria's Regional Forest Agreements (RFAs) and the forest management system they accredit.

As a community-based science organisation operating independently of both government and research sectors, the Royal Society of Victoria will be recruiting members of the Scientific Review Panel for this process, convened to test the science that informs forthcoming forest management reforms for the Department of Environment, Land, Water and Planning.

The Victorian Government is investing in science and data to better understand the range of forest values in Victoria and the systems and processes which underpin forest management planning and decision making.

Join us for the first in a series of public lectures to hear from some of the scientific experts leading the assessment of Victoria's public forest values.

Speakers will include:

Dr Rebecca Ford

Understanding community values in Victoria's public forests

Dr Rebecca Ford is a Senior Research Fellow at the University of Melbourne, concerned with social dimensions of forest and fire policy and management. She draws on psychological and interdisciplinary frameworks to study people and their interactions with forests and forest management by observing aspects such as values, experience, public acceptability, institutions and decision-making. Building on an earlier career in forest policy, including RFAs, her research is based in long term engagement with environmental managers.

Dr Ford and her colleagues have investigated community values of forests, including their natural, experiential, recreational, productive and cultural attributes. Through large scale surveys of the general public, they have identified the relative importance placed on these values and have explored links between values and the public acceptability of management practices. These findings will help to structure RFA

community values assessments and to identify gaps in existing information. This will contribute to the design of assessments and community engagement that incorporate values of the public in modernised RFAs.

Dr Lindy Lumsden

Landscape Scale Species Surveys

Dr Lindy Lumsden is a Principal Research Scientist and Section Leader of the Wildlife Ecology Section of the Arthur Rylah Institute, DELWP's biodiversity research institute. She has been leading DELWP's research on improving understanding of threatened species distribution and relative abundance in relation to timber harvesting since 2012 with a focus on Leadbeater's Possum, Greater Glider and Long-footed Potoroos. She provided scientific input into the Leadbeater's Possum Advisory Group process and has been leading the implementation of research recommendations from that process. She is currently leading the Landscape Scale Surveys for the RFA renewal process and had a key role in designing the Pre-harvest surveys for threatened species.

Dr Lumsden will outline the plan for undertaking Landscape Scale Surveys, including the priority species to be surveyed, the survey rationale and design, and the techniques to be used.

Dr Graeme Newell

Habitat Distribution Modelling

Dr Graeme Newell taught physiology at Deakin University for nine years, where he also completed his PhD on the effects of the forest disease cinnamon fungus on habitats of native mammal fauna. He later held a post-doctoral fellowship with the CSIRO/Co-operative Research Centre for Tropical Ecology & Management. During this time he studied the effects of habitat loss upon the rare, arboreal Lumholtz's Tree-Kangaroo Dendrolagus lumholtzi in tropical rainforest. He has been employed as a research scientist with DELWP at the Arthur Rylah Institute since 1997, and he is currently the program leader for large team of ecologist, modellers, and software developers.

In recent years Dr Newell has been involved in the development of new datasets for Government agencies on the distribution, type and condition of native vegetation, the distribution of both common and rare native plant and animal species, landscape connectivity, modelling the potential impacts of climate change on biota, and developing integrated tools for conservation planning, prioritisation and management.

Associate Professor Craig Nitschke

Mapping rainforest and old growth forest using aerial laser scanning

Associate Professor Nitschke is a forest and landscape ecologist with the University of Melbourne. His research focuses on the impacts of management, disturbance and climate on forest ecosystems, adaptation to climate change and the sustainable management of forests.

He will present on the use of aerial laser scanning and modelling techniques for accurately mapping rainforest and structurally mature (old growth) forests in Victoria.

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

Rain, Hail or Shine

Thursday, 14th 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. **RSV Members** should check their emails, or call the RSV office to access their **discount code**.

Fashionable Science: Wearables, Functional Textiles & Circular Fashion

Thursday, 28th 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

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. **RSV Members** should check their emails, or call the RSV office to access their **discount code**.

From the President

Being RSV President reminds me of the song "The never-ending story." So much to do ….so little time. Besides chairing a Council Meeting and an Executive Board Meeting I was recently invited to speak at the ACU's International Kids' Conference where I spoke on the significance of Reading, Research and Explaining in STEM.

I also had the audience of about 140 year 7, 8 and 9 students together with about 15 teachers get up and learn 3 songs about Reading, Researching and Explaining science. Luckily my occupation is not that of a singer - but the conference attendees seemed to enjoy this musical approach to STEM.

Very soon we will be hearing presentations from the two RSV Medallists, followed by a dinner which is open to all the Society's Members and their guests. The Governor of Victoria, Linda Dessau, who is the RSV's Patron, will be presenting the Medals ahead of this significant function on 13th December.

Planning is well underway for our spectacular 2019 lecture program. A great variety of topics from very interesting speakers awaits us next year.

On behalf of all the Members I'd like to thank our small (mainly part-time) staff team (Mike, James, Malourie, Ann and Renee) who have provided outstanding service to the Society. Your exceptional support is greatly appreciated by all.

And finally, together with the current Executive Members and half the Council, I and they are all standing for re-election. I've encouraged all to re-nominate as I believe the Council is working as a cohesive group to enhance the Society's financial position through our planned Magic project which, has as its sole aim, to provide the Society with a quantum of funds for the next 50-plus years.

Elsewhere in this newsletter are details of the Members' Conference planned over two days in early February, which will seek your input to the Magic project.

Please feel free to contact me on 0418 346 999 or via email at president@rsv.org.au about any RSV issues you wish to raise.

I wish all members a wonderful Festive Season and a Happy, Healthy and Safe 2019.

- **David Zerman, President**

Vale

Mr Malcolm Carkeek

The Society's Council, Officers and staff mark with sadness the passing of former RSV Councillor and Honorary Archivist, Mr Malcolm Carkeek on Wednesday, November 21, 2018. Malcolm's diligent work on our archives was remarkably meticulous and professional, meaning some important historical documents from our organisation will soon be preserved with the State Library of Victoria for access by historical researchers for years to come, for which he has our enduring gratitude. We convey our deepest condolences to Deirdre and family.

Nominations for RSV Membership

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

Dr Anthony John **BOXSHALL**, Principal & Founder, Science into Action
Mr David William Buesst **PLANT**, Retired
Mr Paul **ROSS**, Student

Ms Elizabeth **DOWLING**, Solicitor
Ms Monika **HORNACKOVA**, Student

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 14th February 2019. Recently elected members who have not yet signed the Society's membership book are warmly invited to attend the 8h 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.**

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

Magic: Notice of RSV Members' Conference, 1 and 8 February, 2019

Form and Function – the RSV's Development Options

Members are advised the Society will be holding a two-day conference on successive Fridays in the first two weeks of February. Each day will focus on different aspects of our development proposal.

Day one will be a concern with "next order" sustainable development; the incorporation of renewable energy sources, water capture, retention and reticulation, and passive heating and cooling opportunities. Further, we seek to push the planning envelope to concern ourselves with how urban development can provide ecological niches for native wildlife and plants, both in the design of a tower and in the balance of the Society's site. We will be bringing suitable expertise into the mix to help us to understand opportunities to create a new benchmark for 21st century urban planning and development.

Day two will be a concern with function; what new facilities the development could deliver for the Society's future use, balancing big ideas with the pragmatic concerns of business purpose, precinct character and economic sustainability.

We will advertise further details in the coming month – meanwhile, please save these dates, as registration requires a commitment to attend both days.

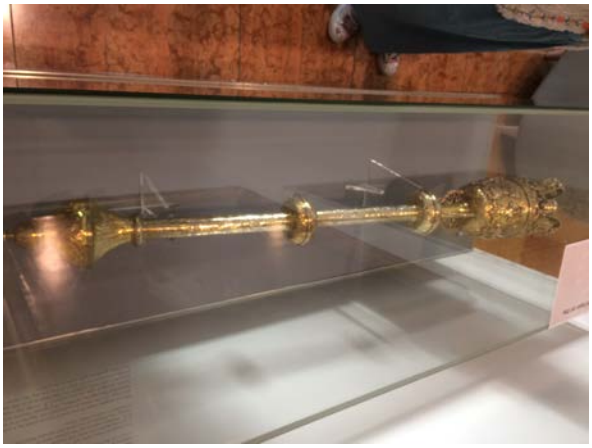
Our Man in London

Our long-serving Business Manager and caretaker, **James McArthur** and wife Amanda took their tribe on a tour of Europe this year, where they made good use of his RSV business card to storm the gates of the Royal Society of London!

James reflects that in many ways, our distinguished eponym's modern business practices are very similar to ours, balancing

their heritage with contemporary functions. Venue hire to government and other agencies was obviously a feature of the daily business, while elements of the institution's remarkable history were on display for guests to inspect.

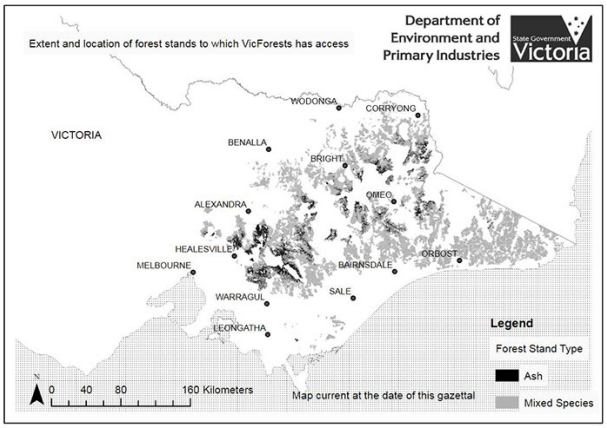
The scale of the Royal Society of London's operational and functional scope is of course quite different. The Royal Society of London is more an international equivalent of our Australian Academy of Science, balancing their roles as the UK's national science academy with a Fellowship program that recognises 1,600 of the world's most eminent scientists, including some of our Australian colleagues.



Founded in 1660, the "invisible college" received royal approval from King Charles II in 1663. This is the gilt mace presented to the Royal Society by the King as a "mark of royal favour," still placed on the table in front of President of the Royal Society before commencement of meetings of Council and the Society.

Our thanks to James and family for bringing back some great photos from "the Mothership!"

Statement of Concern – Logging in Victoria



The gazetted, low-resolution Victorian Government map relied upon to enforce the allocation of areas available for logging under the Sustainable Forests (Timber) Act 2004.

Source: https://www.abc.net.au/news/2018-11-21/victorian-forests-appear-to-have-been-logged-illegally/10496424

The Council of the Royal Society of Victoria is greatly concerned at media reports of logging activities by **VicForests** in coupes outside those areas specifically allocated by law (Allocation Orders). The Council is also concerned that departmental maps that supposedly demonstrate where logging is allowed are not of sufficient resolution to confirm whether the law has been broken (DEWLP statement on November 18). Given the detrimental environmental effects of timber harvesting on threatened species, the Council urges those responsible for administering the industry to ensure that the law is strictly adhered to through the use of modern mapping techniques (such as satellite mapping, GPS, GIS and aerial surveys) and ongoing monitoring.

Research Spotlight

with Priya Mohandoss MRSV

Mr Axel Newton

2018 YSRP Prize Winner for the Biological (non-human) Sciences

Research topic: "Investigating Convergent Evolution between the Thylacine and Canids"

From an early age, films such as Gattaca and Jurassic Park sparked Axel's interest in the idea of de-extinction and genetic engineering. After graduating from a Bachelor of Biological Sciences with Honours at Deakin University, Axel first pursued a Masters and then a PhD at the University of Melbourne.

His research involved the use of CT scanning to create 3D digital models from thylacine specimens located in Melbourne, Tasmania and Prague, comprising of dry skulls and whole body re-constructions of 11 different types of thylacine pouch young. These models have allowed him to study the thylacine's skeleton and internal organs, and reconstruct their growth and development.

In conjunction with his supervisors, Dr Andrew Pask and Dr Christy Hipsley, and an extensive research team, Axel was able to focus on the morphology of skull evolution (study of the form and structure of organisms and their specific structural features) through the study of thylacine skulls and compare these with skulls from canids and other mammals. He also analysed and obtained data from a preserved series of thylacine pouch young specimens that had never been interacted with before in this manner, due to their fragility and rarity.

Although his research has only just scratched the surface, for the first time, Axel has been able to establish a model of an extinct marsupial that can be used to address many fundamental questions in biology, specifically in the field of genetics, with related research focused on the function of the epigenome, a highly adaptive system that regulates the particular expression of an organism's relatively fixed genome, with impacts on growth and behaviour. As a result, much of this current information has far-reaching consequences, whether it be in medical and scientific fields or general interest and exploration. Furthermore, anything that can be learnt through the thylacine also carries applications in terms of preventing the extinction of other organisms in the future.

Bringing the thylacine back is within the realms of the possible, but Axel emphasises that any attempts should be to ensure this remarkable creature's second chance at survival, rather than for commercial purposes.

On completing his PhD, Axel plans to carry on his thylacine research at the University as a post-doctoral fellow and then focus on building his career in academia.

* * *

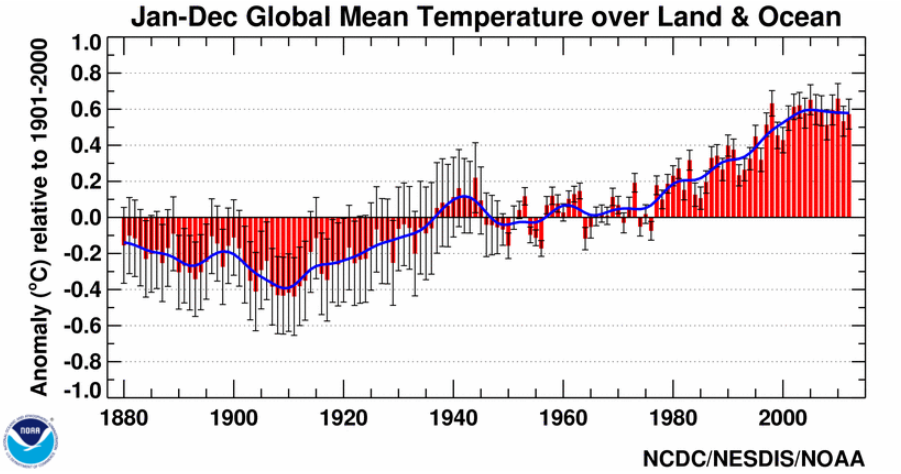
Priya Mohandoss holds a Bachelor of Science, a Master of Journalism and a Masters of Communications and Media Studies from Monash University.

The Royal Society of Victoria – Official Position on Climate Change

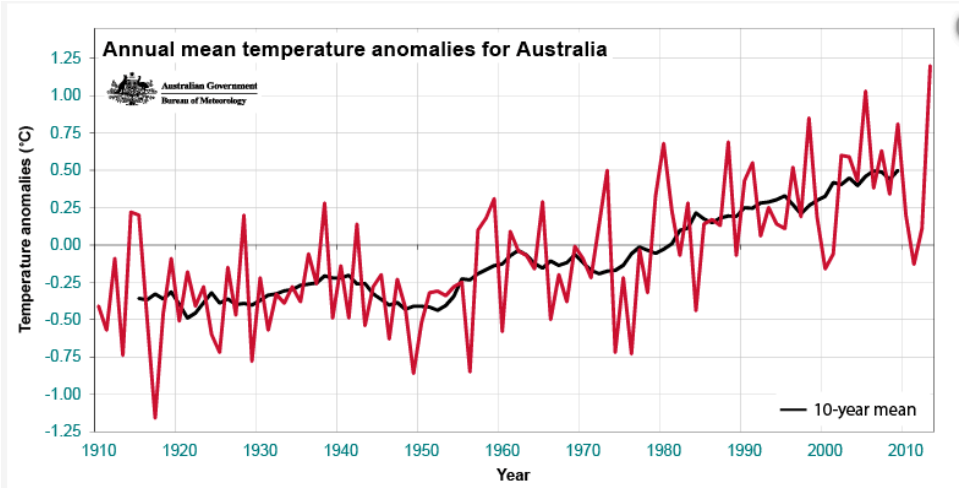
Circulation Draft

This position paper has been developed through the Society's Policy and Communications Committee and is now authorised for circulation for review and consideration by the Society's membership. Comments may be directed to the Chair of the Policy and Communications Committee, Dr Peter Baines at p.baines@unimelb.edu.au for consideration up until January 31st, 2019, after which time the paper will be adopted as the Society's Official Position and supersede earlier positions on this matter.

The official position of the Royal Society of Victoria is that, given the irrefutable scientific evidence for human activity driving climate change, it is vital that policies that curb greenhouse gas emissions from all sources be developed and implemented as a matter of urgency on a global basis.



Global climate change and global warming are real and observable. The global mean surface temperature of the Earth increased by around 0.9°C from 1880 to 2012. The first decade of the 21st century was warmer than any other decade since at least 1850 (when global temperature measurements first became available). The rate of warming has been largest in the latter part of the 20th century. Global surface temperatures increased by about 0.7°C from 1951–2012. Since the 1980s every decade has been warmer than any other decade since 1850, and each successive decade has been warmer than the previous one. Moreover, 2016, 2015, 2017, 2014, 2010, and 2005, in that order, were the six warmest years on record.

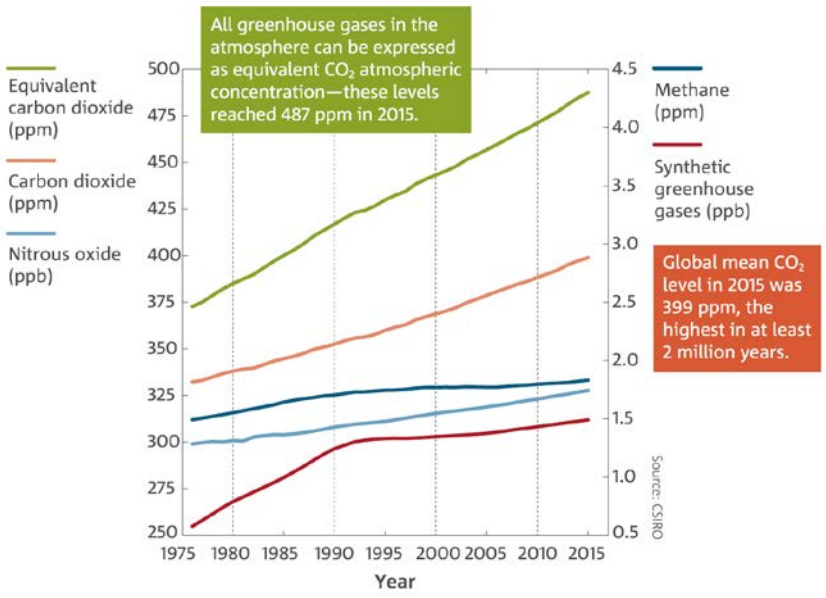


Annual mean temperature anomalies for Australia, 1910 – 2012. Source: Bureau of Meteorology

Australia's climate is changing. Since the introduction of robust, instrumental surface temperature measurements in the early 20th century the mean surface temperature of Australia has increased by about 0.9°C. This is similar to the global average increase. Warming is slightly stronger in night-time minimum temperatures than in daytime maximum temperatures. This warming has been concentrated in the post-1950 period with little trend prior to 1950. Mean temperatures have increased in all parts of Australia, with the strongest warming trends in the central and eastern interior of Australia and the weakest in parts of northern Western Australia and some parts of New South Wales. The year 2013 was Australia's hottest year on record, with 2014 ranking third, and 2016 ranking fourth. During the instrumental record (since 1910), Australia's four hottest years, and nine of the ten hottest, have occurred since 2002.

The composition of gases in our atmosphere is crucial to maintaining a warm planet and life on Earth and even small changes to this composition can have a big effect on our climate. Water vapour, carbon dioxide

and other gases that are present in small amounts (often collectively called **greenhouse gases**) increase the capacity of the atmosphere to absorb and emit infrared radiation. The mean surface temperature increases as the atmospheric concentration of greenhouse gases increases because the atmosphere emits more infrared radiation (both upwards and downwards), some of which is absorbed by the Earth's surface. It is for this reason that the mean surface temperature is higher than it would be otherwise, without an atmosphere or greenhouse gases. This process, called the natural greenhouse effect, keeps the surface of the Earth and the lower atmosphere warm enough to sustain the mean global surface temperature of about 15°C.



Proportions of greenhouse gases in the atmosphere, 1975 - 2015. Source: Bureau of Meteorology

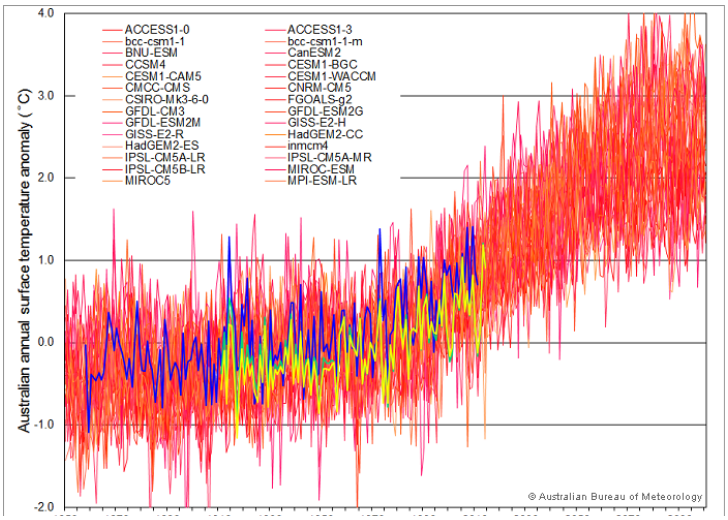
It is now certain that the human activities that have increased the concentration of greenhouse gases in the atmosphere contribute significantly to observed warming. Further, it is extremely likely that these human activities are responsible for most of the observed global warming since 1950. The warming that is associated with increases in greenhouse gases originating from human activity is called the enhanced greenhouse effect. The atmospheric concentration of carbon dioxide has increased by around 40% since the start of the industrial age, and has been measured as higher now than at any time in at least the past 800,000 years. In 2015 the amount of carbon dioxide in the atmosphere exceeded 400 ppm, which is a level likely last seen 2–4 million years ago. The increase in carbon dioxide is a direct result of burning fossil fuels, broad-scale deforestation and other human activity. Concentrations of a range of other potent greenhouse gases, such as CFCs, methane and nitrous oxide, have also increased as a result of human activity, and have contributed to the observed warming. Some other by-products of human activity, most notably industrial aerosols, have had a cooling effect on the atmosphere, and have offset some of the warming from the enhanced greenhouse effect.

Why are we confident that the warming is due to human activity rather than natural climate variability? First, the observed warming in recent decades is consistent with the fundamental theories of the physics of the atmosphere and its behaviour. **Second**, estimates of past climates suggest that the mean surface temperature of the Northern Hemisphere in the late 20th and early 21st centuries exceeds the temperature at any time during at least the last 1,400 years. **Third**, climate models (computer simulations of the Earth's climate) correctly simulate the temperature record of the 20th century (including some periods of relative cooling) when both natural factors (internal climate variability, volcanic emissions) and human influences (increased greenhouse gases and aerosols, and decreased stratospheric ozone) are included, but not if human influences are omitted.

Our climate is very likely to continue to change as a result of human activity.

Global temperature increases are already set to continue until at least the middle of this century, even if emissions of greenhouse gases were reduced to zero. The magnitude of warming and related changes can be limited by controlling the total amount of carbon dioxide and other greenhouse gases emitted into the atmosphere as a result of human activities; future climate scenarios depend critically on future changes in emissions. Future global mean temperatures over the period 2016–2035 are likely to be 0.3°C to 0.7°C higher than temperatures in the period 1986–2005. By the end of the 21st century, with a rapid transition away from fossil fuels, climate models suggest warming ranging from 0.3–1.7°C and sea-level rise ranging from approximately 0.3–0.6 m. With ongoing intensive use of fossil fuels the projected ranges of warming and sea-level rise are approximately 2.6–4.8°C and 0.5–0.9 m, respectively. In the short-term (out to 2030), most of the uncertainty in these projections is due to the uncertainty in the way climate models represent

physical processes. Later in the century, the economic and population growth and the future level of greenhouse gas emissions and anthropogenic aerosols become the dominant uncertainties.



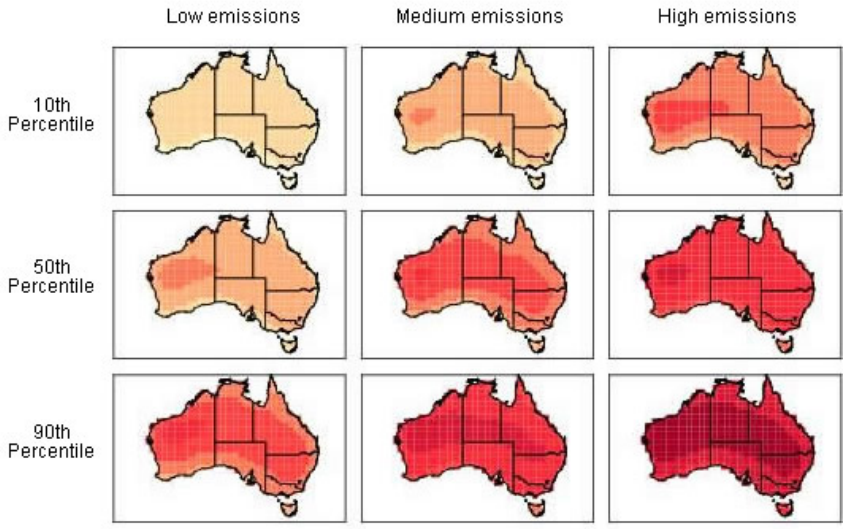
Source: Bureau of Meteorology

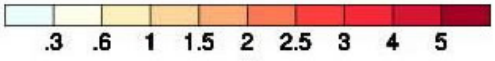
The mean Australian surface temperature is likely to increase by between 0.6 and 1.3°C by 2030 when compared to the period 1986–2005. This range of warming for 2030 is similar for all emissions scenarios. However, the rate and amount of carbon dioxide produced into the future becomes more influential by 2090. Continued intensive emissions, a so-called high emissions scenario, is likely to produce an increase in Australian average temperatures of 2.8°C –5.1°C by 2090. A rapid reduction in the amount of carbon dioxide emitted is critical to control temperature increases that are limited to between 0.6°C and 1.7°C.

Climate models suggest that the warming in inland Australia will be larger than in coastal areas, with the least warming (on an annual mean basis) expected in southern Australia. There are also seasonal differences in warming, with the greatest warming likely to occur in the spring.

There is very high confidence that Australian sea levels will continue to rise during the 21st century and that the oceans surrounding Australia will become more acidic, affecting marine ecosystems, especially the Great Barrier Reef.

The official position of the Royal Society of Victoria is that, given the irrefutable scientific evidence for human activity driving climate change, it is vital that policies that curb greenhouse gas emissions from all sources be developed and implemented as a matter of urgency on a global basis.





2070 Projections. Source: Dept of Climate Change & Energy Efficiency, CSIRO, Bureau of Meteorology

For further information see:

The AMOS Climate Change Statement, Feb. 2016.

Climate Change in Australia: http://www.climatechangeinaustralia.gov.au

Intergovernmental Panel on Climate Change – 5th Assessment Report: http://www.ipcc.ch

IPCC Special Report on global warming of 1.5C: http://www.ipcc.ch/report/sr15/ .

Australian Academy of Science - The Science of Climate Change, Questions & Answers. https://www.science.org.au/learning/general-audience/science-booklets-0/science-climate-change

The Royal Society of Victoria

2019 Program

14 February ***– Rain, Hail or Shine: the Secrets of Severe Weather***
Dr Joshua Soderholm

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

14 March ***- The Future of Electronics: Beyond the End of Moore's Law***
Panellists TBC

28 March ***- The Marvels of Medicinal Plants***
Dr Tien Huynh

11 April ***- Moneyball 2.0: Analytics and technologies improving high performance sports***
Dr Sam Robertson and Professor Damian Farrow

9 May ***- Annual General Meeting***

- Gamble, Drink, Consume, Repeat: Why we need BrainPark
Professor Murat Yucel

23 May ***- The Cognitive Processes of Bees: Recognising faces and the concept of zero***
Associate Professor Adrian Dyer

13 June ***- Howitt Lecture***
Speaker TBC

27 June ***- Edible Nature Strips & Subsidised Worm Farms: Solutions to protect people & planet***
Liza Barbour

25 July ***- Joint Lecture with ATSE Vic***
Speaker TBC

8 August ***- Mind Over Faecal Matter: Gut Biome and Mental Health***
Dr Eilsa Hall and Associate Professor Ashley Franks

10 – 18 August ***- National Science Week***

15 August ***- Young Scientist Research Prizes Competition***

12 September ***- Communicating Astrophysics***
Professor Alan Duffy

19 September ***- Phillip Law Lecture***
Award Winner TBC

26 September ***- Fire and Pyrodiversity***
Dr Luke Kelly

10 October ***- Epilepsy, Algorithms and AI: Personalised Seizure Forecasting***
Professor David Grayden

24 October ***- Fungi and Fungimap***
Dr Sapphire McMullan-Fisher

14 November ***- Free Radical Chemistry***
Associate Professor Uta Wille, Dr Caroline Kyi

28 November *- TBC*

12 December ***- Research Medal Award, Lecture & Annual Dinner***
Medallist TBC