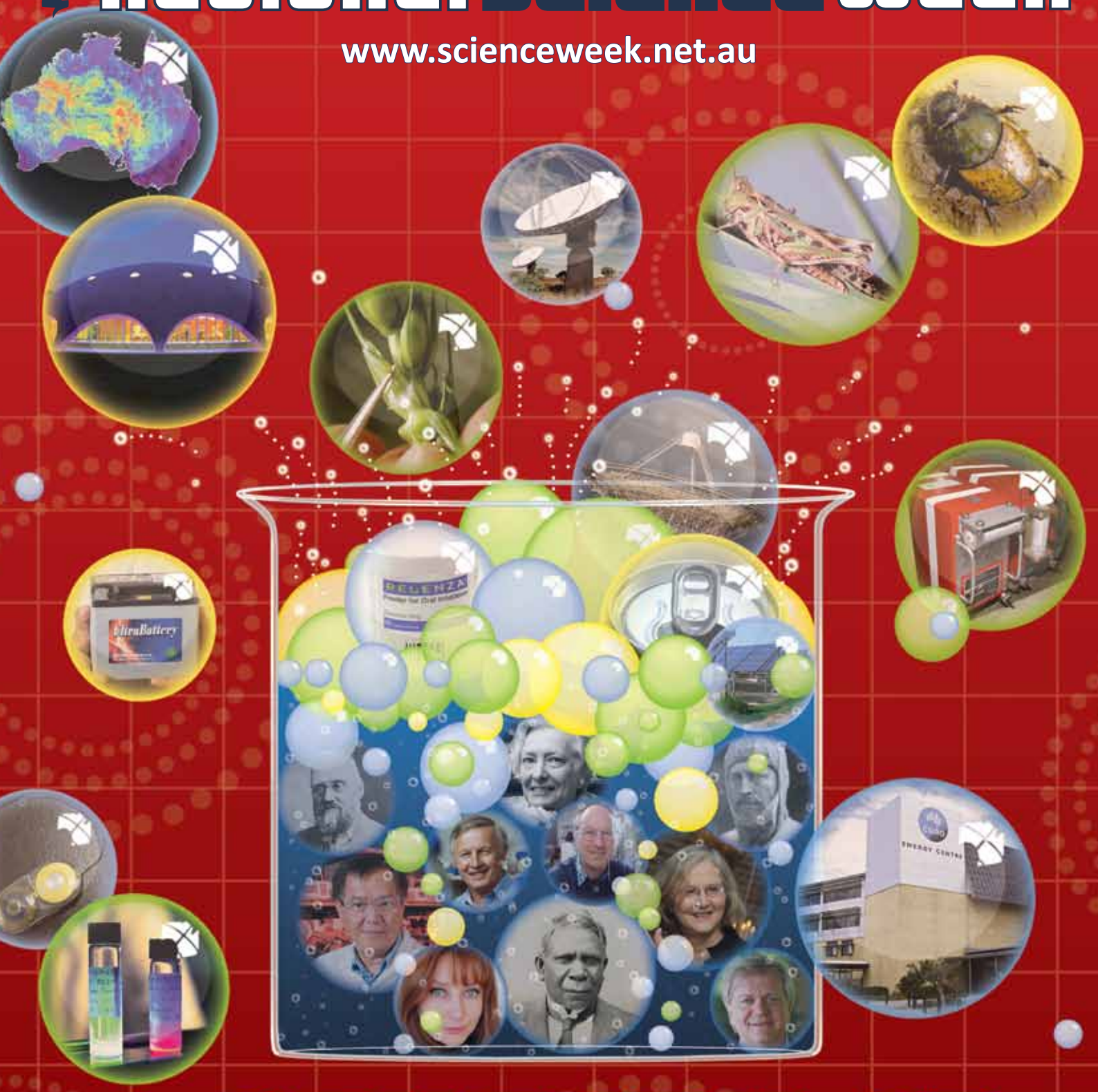
national science week

www.scienceweek.net.au



A CENTURY OF AUSTRALIAN SCIENCE

A resource book of ideas for National Science Week 2013

Acknowledgements

An Australian Government Initiative

Inspiring Australia

Australian Science Teachers Association

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MINISTER'S FOREWORD

What is science? It is not just the business of labs coats and test tubes. It is the business of changing the world. Experiment by experiment, step by step, our knowledge of our planet advances. Our lives change for the better. And our dreams for our children expand.

As a nation, we ask a great deal of our scientists and researchers. We ask them to help us feed the hungry, cure the sick and save the planet. We look to them for answers to help our industries stay strong.

They need, in exchange, the support of the entire nation. And if history is our guide, this is a very safe investment.

We have a great record of scientific excellence, which has made a profound impact in this country and well beyond. It is a record that deserves to be celebrated. Australians can all take pride in our Nobel Prize winners and globally-renowned researchers; our backyard inventors and innovators; our contribution to such great global projects as the Square Kilometre Array.

This is a clever, a creative and a highly capable country. Its past achievements are great, and its future is ours to build.

That is the message of this year's National Science Week Resource Book, a celebration of a century of Australian scientific excellence. 2013 marks the Centenary of Canberra, Australia's national capital and home to some of our leading scientific institutions. You will read of their contribution to our great science story; from the Mount Stromlo Observatory, to the Australian Academy of Science,to Questacon – The National Science and Technology Centre.

At the same time you will journey through one hundred remarkable years, spanning the period from early Antarctic exploration to today's world-leading research in nanotechnology and biotechnology. *A Century of Australian Science* highlights the remarkable people, both the famous and the less well-known, whose research and discoveries have helped transform the way we live. It is a resource to inspire, to engage and to empower.

Since National Science Week's inception in 1997, millions of Australians have taken part in an array of events, activities, talks and shows across the length and breadth of the country. This year's celebration will continue to reach out to Australians of all ages, sharing the wonders of science and helping us to understand the role it plays in our lives.

I encourage schools and the wider community to join us in promoting the power of ideas.

Senator the Hon Kim Carr

Minister for Science and Research

July 2013

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- ✓ Supplementary resources
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  New interactive resources to support the teaching of each curriculum unit
- **Year 7 Curriculum units:**
  5 new units to cover the requirements of the Australian Curriculum: Science Year 7

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Australian Academy of Science

The Primary**Connections**: Linking Science with Literacy project is supported by the Australian Government Department of Education, Employment and Workplace Relations through the Mathematics and Science Participation Program.

Linking science with literacy

PRESIDENT'S MESSAGE

Australia has a long pedigree of scientific achievements, the result of many years of research and commitment by Australian scientists and science institutions. The advances in our scientific knowledge over the last 100 years are impressive, and along with the scientists who contributed to this knowledge, should be celebrated.

The Australian Science Teachers Association was inspired by the centenary of Canberra (1913–2013) and the Science as a Human Endeavour strand of the Australian Curriculum: Science to choose the 2013 National Science Week in schools theme – *A Century of Australian Science*.

ASTA is pleased to release its 2013 National Science Week resource book entitled *A Century of Australian Science* for both teachers and community educators. This is ASTA's 29th resource book and the second that has been delivered as a web-based digital book, available free to all on the ASTA website.

ASTA gratefully acknowledges the funding support from the Australian Government through the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education. On behalf of ASTA I would like to thank the authors and designer of *A Century of Australian Science*, the ASTA National Science Week representatives in each state and territory and all the teachers in schools who participate in National Science Week with their students.

I hope *A Century of Australian Science* provides you with a storehouse of information and associated activities to help celebrate the achievements of Australian scientists with your students – not only during National Science Week 2013 but also well into the future.

Dr Stephen Zander

President of ASTA

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INTRODUCTION

INTRODUCTION

A Century of Australian Science has been written to assist teachers and community educators in the celebration of Australia's festival of science – National Science Week.

In 2013, Canberra, Australia's national capital, is celebrating its centenary. Many national scientific institutions are based in Canberra including the Mt. Stromlo Observatory established in 1911, and the Australian Academy of Science founded in 1954 to recognise outstanding contributions to science. A more recent addition is Questacon – the National Science and Technology Centre, which plays a significant role in science communication to the public. For this year's National Science Week teacher resource book, Canberra's centenary has been used as a 'springboard' to celebrate the history, development and progress of scientific endeavour in Australia over the last 100 years.

How to use this book

This digital book is a tool forall teachers and community educators to introduce their studentsto this exciting era in Australia's science history. The book is divided into 'chapters' that feature a variety of activities (and links to many more) that can be implemented to enhance any science program, either in classrooms or in the community. Activities have allocations/suggestions for recommended year levels from Foundation–Year 12, with some activities easily adapted and adjusted according to students/childrens' learning needs.

Activities cover a variety of science understandings as indicated in the Australian Curriculum: Science, from across the year levels; for example biology's Howard Florey's mould experiment (ACARA Year 6 Science Understanding: *The growth and survival of living things are affected by the physical conditions of their environment* ACSSU094). These activities also allow students to develop and consolidate Science Inquiry Skills such as questioning, predicting and the planning and conducting of a variety of investigations.

The Science as a Human Endeavour strand of the Australian curriculum is a particularly strong feature of this year's book, as it highlights the contribution of science and science knowledge to Australia's development as a nation. Students will have the opportunity to explore the important contributions to the advancement of science made by people from a range of cultures. The book also features the role that Australian science and innovation has played in solving problems thatdirectly affected the lives of people in Australia and across the globe.

How this book is structured

The first section of the book celebrates 100 years of science in Australia by profiling 100 scientists who have contributed to Australian science over the century. Each scientist has a brief biography plus a web link to more information and/or activities related to their research and discoveries. The scientists are colour coded according to their science discipline and based on the Science Understanding strand and sub-strands of Biological sciences, Chemical Sciences, Earth and space sciences and Physical sciences.

The next section highlights the organisations and facilities that have educated and continue to educate, inform and support science in Australia today. Students can read about these institutions and their academic achievements and be inspired by the potential of Australian science.

The book also features information about the lauded Nobel Prizes, including information about Alfred Nobel and how the awards came about. Students can also read information about ambassadors for science in Australia today, including high profile media personalities. This section also includes a variety of information about science awards and competitions that are offered throughout Australia, how teachers and students can actively participate in these competitions and offers links to ideas they can use to inspire and excite.

All of the scientists profiled in *A Century of Australian Science* have been mapped against the relevant Science as a Human Endeavour content descriptions Year 1–10. A table allows teachers to sort by SHE and quickly access information relevant to the course of learning.

An exciting supplement to this year's book is a digital map of Canberra and surrounds that highlights the scientific organisations and institutions that call Canberra home. Students can explore the map and follow links to more information about all of these science sites!

Safety awareness

All activities included in *A Century of Australian Science* have been designed or selected to minimise hazards. However, there is no guarantee that a procedure will not cause injury. Teachers and community educators need to be aware of the special considerations surrounding practical activities in the classroom and ensure that students are suitably clothed for outdoor experiences. Teachers and community educators should test all activities before using them in class and observe the OH&S requirements of their own state or territory. All necessary safety precautions should be outlined clearly to students prior to the commencement of any activity.

We hope you enjoy this year's National Science Week book.

100 YEARS OF SCIENCE

A CENTURY OF AUSTRALIAN SCIENTISTS

The following 100 scientists and innovators have made significant contributions to Australian science over the past century. They were either born in Australia or have spent considerable time researching in Australia. Some will be well-known and others quiet achievers, but each has made an important contribution to their field of expertise and has improved the world in which we all live.

The scientists are listed in loose chronological order, largely based on the period when they were practising scientists.

KEY	
Field of Expertise (Science Understanding Strand)	
Biological Sciences	
Chemical Sciences	
Earth and Space Sciences	
Physical Sciences	

	SCIENTIST	FIELD OF EXPERTISE (Science Understanding Strand)
1	John MacGarvie Smith	
2	Dr John McConnell Black	
3	Sir David Orme Masson	
4	William Ernst Crooke	
5	Professor Ernest Willington Skeats	
6	Sir Douglas Mawson	
7	George Nicholas	
8	Gwynneth Vaughan Buchanan	
9	Professor Walter Lawry Waterhouse	
10	Dr Cyril Callister	

	SCIENTIST	FIELD OF EXPERTISE (Science Understanding Strand)
11	Professor Victor Bailey	
12	Sir William Ian Clunies Ross	
13	Sir Norman Gregg	
14	Professor Raymond Dart	
15	Dr Mark Lidewell	
16	Dr Ian Wark	
17	Dr Alf Howard	
18	Arthur Turner	
19	Dr Albert Pugsley	
20	Dr Hedley Marston	
21	Sir Noel Bayliss	
22	Professor Dorothy Hill	
23	Dr Adrien Albert	
24	Ruby Payne-Scott	
25	Dr Winifred Curtis	
26	Sir Mark Oliphant	
27	Professor David Craig	
28	Dr Douglas Waterhouse	
29	Dr Joan Freeman	
30	Dr Arthur Birch	
31	Professor Kim Campbell	
32	Dr Isobel Bennett	
33	Dr John Cade	
34	Professor Frank Fenner	
35	Dame Kate Campbell	
36	Sir Alan Walsh	
37	Dr David de May Warren	
38	Sir Ronald Nyholm	
39	Dr Yvonne Aitken	
40	Dr Charlotte Anderson	

	SCIENTIST	FIELD OF EXPERTISE (Science Understanding Strand)
41	Dr Saul Weiner	
42	Dr Ian McWilliam	
43	Professor Bernard Mills	
44	Professor Gordon Ada	
45	Professor Bill Compston	
46	Professor Ronald Bracewell	
47	Professor Peter Bishop	
48	Professor Bruce Holloway	
49	Dr David Robinson	
50	Professor Alan Parker	
51	Arthur Bishop	
52	Helen Brookes	
53	Dr John Phillips	
54	Professor Don Metcalfe	
55	John Paul Wild	
56	Dr Basil Hetzel	
57	Dr Henry Harris	
58	Professor David Curtis	
59	Professor Ian Ross	
60	Dr Roger Norse	
61	Bill Mollison	
62	Professor Ted Ringwood	
63	Professor Ken Freeman	
64	Dr Robin Bedding	
65	Professor Brian Anderson	
66	Dr Paul Fraser	
67	Professor Graeme Clark	
68	Professor Fiona Stanley	
69	Professor Jennie Brand-Miller	
70	Professor Collin Sullivan	

	SCIENTIST	FIELD OF EXPERTISE (Science Understanding Strand)
71	Professor Adrienne Clarke	
72	Professor Amanda Lynch	
73	Dr Jane Hodgkinson	
74	Dr Karen Kozielski	
75	Dr Allan Hahn	
76	Dr Steve Wilkins	
77	Dr Robert Gilbert	
78	Stephen Newman	
79	Professor Fiona Wood	
80	Jim Frazier	
81	Professor Ray Cas	
82	Dr John O'Sullivan	
83	Dr Colin Nexhip	
84	Dr Martin Banwell	
85	Professor Suzanne Cory	
86	Dr Mark Shackleton	
87	Dr Peter Coppin	
88	Dr Victoria Haritos	
89	Professor Alan Trounson	
90	Dr John Williams	
91	Dr Madhu Bhaskaran	
92	Chris Prideaux	
93	Dr Thilak Gunatillake	
94	Dr Bill Humphreys	
95	Professor Michael Sherburn	
96	Dr Abigail Allwood	
97	Dr Estelle Giraud	
98	Dr Barry Brook	
99	Dr Jane Visvader and Dr Geoff Lindeman	
100	Professor Andrew White	

1. John MacGarvie Smith

John MacGarvie Smith was born in Sydney in 1844. A person with many different interests he contributed to the development of ore assaying and gold extraction processes, collected information about Australia's venomous snakes and the action of their venom. John MacGarvie Smith's enduring contribution was the development of vaccine for anthrax that was not only effective but which could be kept indefinitely without losing its potency. Shortly before his death in 1918, John MacGarvie Smith donated his secret method for producing the vaccine to the New South Wales government so it would become available to all Australians.

Anthrax is a bacterial disease that can affect a wide range of mammals including humans. In Australia, periodic outbreaks of the disease have led to the development of a national response plan called Ausvetplan-anthrax. Find out about how the disease spreads, its symptoms and how the Australian Government responds to outbreaks at the Anthrax page of the Australian Government Department of Agriculture, Fisheries and Forestry *www.daff.gov.au/animal-plant-health/pests-diseases-weeds/animal/anthrax* **(Years 5–12)**

Anthrax has been used as a terrorist threat in the United States of America. See: Nova Online *www.pbs.org/wgbh/nova/education/activities/2815_bioterro.html* **(Years 10–12)**

Interactive learning object 'Making Vaccines', *www.pbs.org/wgbh/nova/bioterror/vaccines.html* **(Years 10–12)**

NASA also has audio and downloadable files about anthrax and bioterrorism *http://science.nasa.gov/science-news/science-at-nasa/2002/01feb_anthrax* **(Years 10–12)**

2. Dr John McConnell Black

John McConnell Black (1855–1951) was a Scottish immigrant who researched the languages of Aboriginal peoples before developing a lifelong interest in the flora of Australia. Black focused on the systematic description of Australian plant species and published the four-part volume The Flora of South Australia, in which he described over 2430 species both native and introduced.

The Australian National Botanic Garden *www.anbg.gov.au/garden/education/resources/index.html* **(Years 7–12)** has a comprehensive online resource list for students interested in botany. Students could develop a catalogue of plants on their school site or home using digital photography to capture an image of each plant. This can then be compared to the images available on the website to identify the species of plant.

3. Sir David Orme Masson

Sir David Orme Masson (1858–1937) was a chemist who was very interested in the development of the periodic table. He was on a sabbatical in England when the elements helium and argon were first isolated and characterised and is credited with persuading their discoverer, Sir William Ramsey, that they belonged to an, as yet, unknown group. This is the group we now know as the Noble Gases. Sir David was a strong supporter of Antarctic exploration, playing a significant part in the organisation of expeditions lead by Sir Douglas Mawson. He was also one of the founders of the Chemical Society of Victoria and the Melbourne University Chemistry Society and other professional bodies.

A biography of the life and work of Sir David Orme Masson can be found at *http://adb.anu.edu.au/biography/masson-sir-david-orme-7511* **(Years 9–12)**

A series of interactive learning objects from the Royal Society of Chemistry which include activities simulating the historical development of the periodic table of the elements is available at *www.rsc.org/periodic-table* **(Years 8–12)**

A series of videos about the elements on the Periodic Table can be found at *www.youtube.com/user/periodicvideos*. Every element has a short video about its properties, discovery and use. **(Years 8–12)**

Lesson plans for engaging middle school with the periodic table of the elements can be found at *www.middleschool-chemistry.com/lessonplans/chapter4* From the American Chemical Society, these resources include worksheets, learning objects, videos and experiments that explore the elements and trends on the periodic table. **(Years 8–10)**

ASTA has FREE copies of the Bayer Periodic table poster available. See *http://asta.edu.au/resources/bayer_periodic_table* for more information.

4. William Ernst Crooke

William Ernst Crooke (1863–1947) was Australia's first government astronomer. He developed a system for cataloguing stars that was adopted internationally in 1908. William Crooke was also a dedicated meteorologist who developed a method for plotting the transit of tropical cyclones and invented a heliochronometer to accurately determine time and true north. He also pioneered the use of radio signals from other parts of the world to accurately measure longitude.

The Square Kilometre Array radio telescope has 50 times the sensitivity and 10,000 times the survey speed of any present radio telescope. Find out about the array and its role in extending our understanding of the Universe at these websites:

'How will the Square Kilometre Array telescope work?', ABC Science *http://www.abc.net.au/science/articles/2012/02/14/3430265.htm#UZgQqGthiSM* **(Years 4–10)**

Australia and New Zealand SKA project *http://www.ska.gov.au/Pages/default.aspx* **(Years 7-10)**

The Astronomical Society of Australia has a wide range of resources available at 'Australian Astronomy', *http://astronomy.org.au/education/resources/learning-all* **(Years 1–10)**

5. Professor Ernest Willington Skeats

Professor Ernest Willington Skeats (1875–1953) was born in Southampton, England but immigrated to Australia to become the chair of geology and mineralogy at Melbourne University. His research in geology and petrology lead to increased understanding of how and why different rock deposits have formed. Professor Skeats published papers on a wide range of topics from the formation of coral reefs, the Devonian volcanics and granites of Victoria to the alkali rock flows of other prehistoric volcanic events.

Although Australia doesn't boast any active volcanoes, our landscape has been shaped by volcanic activity. Maps and information about Australia's volcanic

past can be found at the 'Geoscience Australia' website www.ga.gov.au/hazards/volcano/volcano-basics/where.html **(Years 5–10)**

Conduct a web-based activity exploring recent volcanic activity at 'Oz Volcanoes', http://science.uniserve.edu.au/school/quests/ozvolcanoes.html **(Years 5–10)**

What happens when a volcano erupts? Watch the eruption of Mt. Tongariro in New Zealand www.smh.com.au/travel/travel-news/volcano-eruptions-a-positive-for-nz-tourism-20121123-29xck.html **(Years 5–10)**

6. Sir Douglas Mawson

Sir Douglas Mawson (1882–1958) was driven by his desire to understand the unknown. He was a geologist and geographer who was one of the first to explore Antarctica. During 1907–1909, he completed the longest Antarctic man-hauling sledge journey in Antarctica lasting 122 days. During 1911–1914 he led an expedition to chart the coastline of Antarctica, investigating the ocean between Antarctica and Australia and exploring Macquarie Island. The success of this expedition led to the establishment of permanent bases in Antarctica. Sir Douglas' achievements are commemorated in a website celebrating the 100th anniversary of Australian Antarctic Expeditions that you can find at www.centenary.antartica.gov.au

Have you ever wondered what living in an Antarctic station is like? Visit the Mawson station website at www.antarctica.gov.au/living-and-working/stations/mawson to find out. (Years F–10). You can follow the links to see a time-lapse movie of the station from the last two days, watch interviews with station leaders and investigate the scientific research being done at the station. **(Years 4–10)**

For a child-friendly biography of Sir Douglas Mawson's life visit www.abc.net.au/schoolstv/australians/mawson.htm **(Years 5–8)**

Watch an episode of *Behind the News* about the celebration of his centenary of Antarctic exploration at www.abc.net.au/btn/story/s3363014.htm **(Years 5–7)**

Visit the interactive pages from South Australian Museum www.mawson.samuseum.sa.gov.au/netscape.htm to follow 'In the footsteps of Sir Douglas Mawson'. **(Years 5–8)**

Douglas Mawson. Photo by Frank Hurley
NLA, an23478526

7. George Nicholas

George Nicholas (1884–1960) was a pharmacist who developed a method for making acetylsalicylic acid or aspirin in Australia after the outbreak of world War I. Prior to this the supply of this painkiller was from the German manufacturer who held a worldwide patent for the process. When war broke out the patent was suspended allowing a domestic pharmacist to devise a way to make aspirin for use in Australia. It took many years for George Nicholas to produce pure aspirin for commercial use. Eventually, working with his brother Alfred Nicholas, the tablets we know as 'Aspro' became readily available for use in Australia.

The Royal Society of Chemistry has a booklet of resources including worksheets

and experimental methods for synthesising and purifying aspirin suitable for use with Yrs 11 and 12 students located at *www.rsc.org/learn-chemistry/resource/res00000056/aspirin?cmpid=CMP00000045* **(Year 11–12)**

Find out more about the development of Aspro at *biotechnology-innovation.com.au/innovations/pharmaceuticals/aspro.html* **(Years 10–12)**

A useful PowerPoint that includes the structure of aspirin and information about its action can be downloaded from *freepdfdb.com/ppt/mechanisn-of-action-aspirin* **(Years 11–12)**

8. Gwynneth Vaughan-Buchanan

Gwynneth Vaughan-Buchanan (1886–1945) was a zoologist who researched the comparisons between animals' anatomies. She was particularly interested in marsupials and other types of Australian fauna. Dr Vaughan-Buchanan travelled widely within Australia collecting and examining animals and recording their similarities and differences. This led to her writing a text, Elements of Animal Morphology in 1921, which was used worldwide as a standard text in universities.

Many children are fascinated by the anatomy of humans and animals. There are many interactive learning objects for students from lower primary to secondary age that allow students to explore the structure and function of the human body. Try:

'Anatomy Arcade', *www.anatomyarcade.com* **(Years 5–9)**

'Science: Human body and Mind - Interactive Body', BBC *www.bbc.co.uk/science/humanbody/body/index_interactivebody.shtml* **(Years 5–10)**

'Virtual human', MEDtropolis *http://medtropolis.com/virtual-body* **(Years 8–12)**

For older students interested in dissections there are numerous virtual dissections available. Try:

'Cat dissection online', Penn State University *http://bio.bd.psu.edu/cat* **(Years 8–12)**

'Virtual foetal pig dissection', Whitman College *www.whitman.edu/content/virtualpig* **(Years 8–12)**

9. Professor Walter Lawry Waterhouse

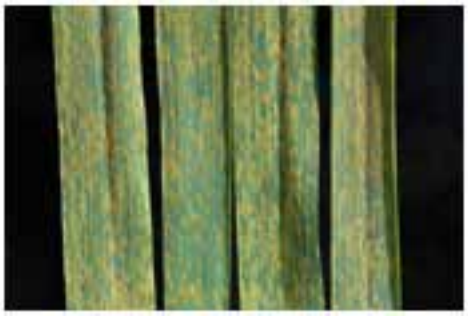
Wheat has always been a crop important to Australians, not only for our own use but also as an export product. Wheat leaf rust is caused by fungi and can destroy wheat crops. The questions of how these rust fungi were transmitted and how they mutated were very important to Australian farmers and to the Australian economy. Walter Lawry Waterhouse (1887–1969) was an agricultural researcher who focused on developing strains of wheat that were resistant to wheat rust. Dr Waterhouse was the first researcher in the world to recognise and explain how wheat rust fungi mutated to produce new varieties. He identified six varieties of rust that are native to Australia and demonstrated how they differed to those found in other parts of the world. Using this knowledge, Professor Waterhouse developed and released for commercial use a variety of wheat called Gabo in 1945. This variety became the leading variety cultivated in Australia and was exported to countries such as Mexico and the United States of America.

Make Frankenstein Easter eggs using wheat or another grass variety *http://suite101.com/article/make-frankenstein-easter-eggs-a199346* **(Years F–6)**

Experiments and projects investigating factors that influence the germination of

seeds can be found at 'Julian's Science Fair', *http://juliantrubin.com/fairprojects/botany/seedsgermination.html* **(Years 4–9)**

CSIRO is breeding rust resistant wheat using DNA technology to ensure that new varieties of wheat are resistant to new types of rust fungi. See 'Breeding rust resistant wheat with DNA technology', CSIRO, *www.csiro.au/en/Outcomes/Food-and-Agriculture/Breeding-rust-resistance.aspx* **(Years 8–10)**



Close-up of wheat leaf rust (*Puccinia triticinia*) on wheat

10. Dr Cyril Callister

Dr Cyril Callister (1893–1949), chemist and food technologist, invented the iconic spread 'Vegemite' in response to shortages of Marmite following the end of the First World War. Dr Callister also developed processed cheeses for the Kraft Walker Cheese Company where he was employed as Chief Scientist and production manager.

One of the main ingredients of Vegemite is brewer's yeast. Yeasts of many types are used in foods such as cheese, yogurt and bread. They are an easy way to introduce students to the fungi kingdom.

Try these recipes:

'Ginger ale', CSIRO Science by email, *www.csiro.au/helix/sciencemail/activities/gingerbeer.html* **(Years F–10)**

'Yeast balloon', Mad about Science website, *www.madaboutscience.com.au/store/index.php?main_page=page&id=6* **(Years 4–10)**

'Basic white bread', Taste website *www.taste.com.au/recipes/10857/basic+white+bread* **(Years F–10)**

'Bread', Topicbox, *www.topicbox.net/RE/bread* **(Years 4–10)**

Vegemite and bread. © ASTA

11. Professor Victor Bailey

Professor Victor Albert Bailey (1895–1964) was a physicist and mathematician who researched electrical conduction in gases before immigrating to Australia in 1923. Here he was a significant contributor to the understanding of the ionosphere, especially the effect it has on radio waves and interference. This work became important to Australian defence forces as it had implications for the use of radar. Professor Bailey's research after the Second World War focused on the interaction of the Earth's magnetic field with electromagnetic signals, pioneering the development of the field now known as 'plasma physics'. Professor Bailey also contributed to entomology when he pioneered the use of mathematical modelling of insect population changes.

The interaction between electric fields and magnets can be hard to visualise. 'Faraday's Electromagnetic Lab' *http://phet.colorado.edu/en/simulation/faraday*

is a simulation from the University of Colorado that allows students to manipulate magnets and electric fields to explore the relationship between the two. **(Years 10-12)**

To demonstrate the effect of electric fields on compasses try the 'Dancing Compass' activity. *www.physicscentral.com/experiment/physicsquest/upload/pq08-activity2.pdf* **(Years 4–10)**

12. Sir William Clunies Ross

Sir William Clunies Ross (1899–1959) a veterinarian with a passion for parasitology whose research lead to the development of vaccines for dog tick and medicines for control of liver fluke. Sir William had a talent for leadership, which paired with his great enthusiasm for science and drive to educate the general public made him the ideal Chairman for the newly formed C.S.I.R.O in 1949. The Commonwealth Scientific and Industrial Research Organisation is Australia's peak research organisation with branches focusing on a wide variety of areas. From the development of alternative energy sources, strategies for management of regional issues such as water resources and the spread of soil salinity to medical issues such as Alzheimer's disease and the flu, CSIRO has researchers seeking solutions to a myriad of problems.

The CSIRO also has a strong commitment to education of the Australian public and has many programs aimed at educating students and stimulating their curiosity and interest in science.

CSIRO website, *www.csiro.au* **(Years 2–10)**

'Teachers', CSIRO, *www.csiro.au/en/Portals/Education/Teachers.aspx* **(Years 4–10**)

Double Helix Science Club, CSIRO, *www.csiro.au/Portals/Education/Programs/Double-Helix-Science-Club.aspx* **(Years 4–10)**

13. Sir Norman Gregg

Ophthalmologist Sir Norman Gregg (1892–1966) was gifted clinical observer who discovered the link between maternal rubella and blindness in babies. He later extended this to report heart defects and deafness as other effects on the developing foetus of rubella infection during pregnancy. Sir Norman was inherently a compassionate and ethical scientist whose consideration of the welfare of the children under his care led him to develop examination and surgical procedures to ensure his patients did not suffer unduly. He was also a driving force behind changes to hospital administration procedures that led to the friendlier, comfortable and homely Children's hospitals we experience today.

Rubella or German measles is a mild viral illness in children and adults that has serious consequences for a developing foetus. Get the facts about Rubella on the 'Rubella fact sheet', WA Department of Health, *www.public.health.wa.gov.au/2/272/2/rubella_fact_sheet.pm* **(Years 8–10)**

14. Professor Raymond Dart

Raymond Arthur Dart (1893–1988) was an anatomist and anthropologist who identified the first fossil ever found of Australopithecus africanus, an extinct hominid. Professor Dart identified some fossil bones from a quarry in Tuang, South Africa as being from an early human based on the brain dimensions of the skull.

Make your own fossils. See: 'Best of fossils', CSIRO Education, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Earth-and-space-sciences-activites/fossil-activity.aspx* **(Years 4–10)**

'Sweet fossils', CSIRO Education, *www.csiro.au/en/Portals/Education/Programs/Do-it-yourself-science/Earth-and-space-sciences-activites/fossil-activity/sweet-fossils.aspx* **(Years 4–10)**

Visit the Australian Museum online for information about Australia's extinct animals *http://australianmuseum.net.au/Australias-extinct-animals* **(Years 4–10)**

15. Dr Mark Lidewell

Dr Mark Lidewell (1878–1969) was an Australian doctor who worked at the Royal Prince Alfred Hospital in Melbourne. He pioneered cardiac medicine in Australia. Dr Lidewell understood how the heart functions, and also how electricity could be used to stimulate muscles to move. The heart is the most important muscle in your body, and is made up of four chambers that move in a set pattern to pump blood around your body. Dr Lidewell, working in partnership with a physicist from the University of Sydney, Dr Edgar Booth, designed a device that could start a heart beating or make it beat in a regular pattern. This was the world's first heart pacemaker. It was made up of two poles that could be connected to mains electricity using a light plug. One of the poles was a pad of cloth that had been soaked in a concentrated salt solution. This was attached to the patient's skin. The other was a needle that was placed directly into the heart. Electricity was applied to make a heart beat between 80–120 times a minute, like the heart of a healthy person. Dr Lidewell first used the pacemaker on a stillborn infant to revive it. After 10 minutes of electrical stimulation, the infant's heart began to beat on its own.

Since Dr Lidewell's successful use of the pacemaker, other scientists have worked to develop the technology that is used today to place heart pacemakers into the hearts of many cardiac patients.

'The History of Heart Pacemakers', Virtual Museum, *www.museevirtuel-virtualmuseum.ca/edu/ViewLoitLo.do;jsessionid=1ADE47F06166BB1381ACC065915B9145?method=preview&lang=EN&id=4090* **(Years 6–10)**

'How to take your pulse', YouTube (1:50 min) *www.youtube.com/watch?v=36zbMwxoM6g* **(Years F–10)**

3D animation of working of heart – 'Videographic: Electric beats - pacemakers and the human heart', YouTube (2:51 min) *www.youtube.com/watch?v=SMXBR_YFocs* **(Years 8–10)**

An artificial pacemaker from St. Jude Medical, with electrode, Steven Fruitsmaak, Wikimedia

16. Dr Ian Wark

Dr Ian Wark (1899–1985) was one of Australia's most influential scientists whose research interests included the consequences of uncontrolled nuclear transmutation, complex ion constitution of heavy metal organic hydroxyacids, electro-deposition of zinc leading to the production of galvanised fencing etc, the physics and chemistry of froth floatation and the absorption of air bubbles on mineral surfaces. Dr Wark was the founder of the Industrial Division of the CSIRO with the goal of developing it as an organisation which would provide technical advice to existing industries, stimulate the establishment of new industries, encourage the use of Australian materials and by-products and to study problems of national importance. These goals are still the focus of the division.

The mining industry provides a feast of opportunities to engage students in chemistry in a 'real' context. For instructions for a few of these, follow the links below.

'Solvent extraction of copper experiment', Oresome Resources *www.oresomeresources.com/resources_view/resource/experiment_solvent_extraction_of_copper* **(Years 10–12)**

'Froth floatation experiment', Oresome Resources *www.oresomeresources.com/resources_view/resource/experiment_froth_flotation* **(Years 6–12)**

'Metals for kids', Science Kids *www.sciencekids.co.nz/metals.html* **(Years 4–12**)

'Rusty steel wool experiment', Kidspot *www.kidspot.com.au/omofunzone/experiment-rusty-steel-wool-experiment+11429+570+sponsor-activity.html* **(Years 4–10)**

'Horrible hydrogen', Horrible Science *www.nickarnold-website.com/experiments/Horrible_hydrogen.pdf* **(Years 6–10)**

17. Dr Alf Howard

Dr Alf Howard (1906–2010) was a hydrologist and Antarctic explorer who was a member of the team led by Sir Douglas Mawson on the RRS Discovery in 1929–1931. During this expedition Dr Howard monitored seawater temperature and composition during this expedition often carrying out chemical analysis under difficult conditions as the ship rolled and pitched in heavy seas. During World War II Dr Howard worked on developing dehydrated meat, fruit and vegetables for use by the armed forces. After the war his work led to the establishment of the frozen meat export industry in Queensland. A scientist of wide-ranging interests Dr Howard's research included soil salinity, psychology statistical analysis and computer programming.

Dr Howard was the longest living member of Sir Douglas Mawson's BANZARE expedition. Find out more about him. See 'Alf Howard: Last living link with the heroic era', *www.antarctica.gov.au/__data/assets/pdf_file/0007/22777/ml_388954854282407_1920alf20howard.pdf* **(Years 2–10**)

Dr Howard's data from the expedition began long-term research into the currents and salinity of the ocean water around Antarctica. Current information about ocean salinity and temperatures around Australia is available at Bureau of Meteorology. See 'Sea temperatures and currents', BOM, *www.bom.gov.au/oceanography/forecasts* **(Years 5–10)**

For activities in modelling the movement of water in the oceans 'Visit to an Ocean Planet: Salinity and Deep Ocean Currents', NASA, *http://er.jsc.nasa.gov/seh/Ocean_Planet/activities/ts1siac2.pdf* **(Years 5–10)**

The Thermohaline current causes the mixing of ocean water globally. This is explained in 'Ocean conveyor belt', National Geographic Education, *http://education.nationalgeographic.com.au/education/encyclopedia/ocean-conveyor-belt/?ar_a=1* **(Years 5–10)**

For videos illustrating the Thermohaline current see:

'NASA: The Thermohaline Circulation (The great ocean conveyor belt)', YouTube (1:24 min) *www.youtube.com/watch?v=3niR_-Kv4SM* **(Years 5–10)**

'Ocean odyssey – Density current', YouTube (2: 40 min) *www.youtube.com/watch?v=FuOX23yXhZ8* **(Years 5–10)**

18. Arthur Turner

In the 1920s and 1930s Victorian and New South Welsh sheep graziers were facing an epidemic of the Black disease decimating their flocks. Arthur Turner (1900–1989) was the veterinarian scientist responsible for the develop-

ment of an effective vaccine for the disease. His research moved from sheep to cattle diseases in the late 1930s resulting in the identification of the cause of bovine pleuro pneumonia and effective treatment and vaccines for infected cattle.

Vaccinations are one way that farmers ensure the health of their livestock and crops. There are many other factors that ensure our food is healthy and nutritious. The CSIRO Animal, Food and Health Sciences website at *www.csiro.au/Organisation-Structure/Divisions/Animal-Food-and-Health-Services.aspx* **(Years 8–10)** showcases research into this area. Ask students to explore and report back to the class on one aspect of the research shown. Students can use the information to write a "From farm to fork" short story for one of the animals or crops displayed.

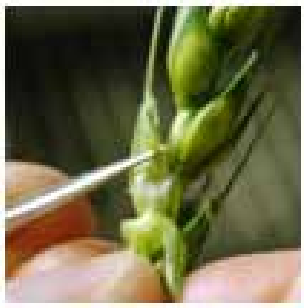
19. Dr Albert Pugsley

Albert Pugsley (1910–2002) was a plant pathologist and plant geneticist who researched the resistance of different species of plants to disease. He developed and bred wheat varieties for crop use in different climates throughout Australia. One variety was named 'Pugsley' as a tribute to his work in this area and is a high yielding wheat with a high resistance to stem and leaf rust strains that are common to South Australia.

Interactive laboratory experiences exploring plant genetics can be found at 'Genetics Web Lab Directory', Education Development Centre, *www2.edc.org/weblabs/WebLabDirectory1.html*
(Years 10–12)

The Australian Centre for Plant Functional Genomics has videos and fact sheets about current research into plant genetics at *www.acpfg.com.au/index.php?id64*
(Years 10–12)

'Get into Genes' highlights the application of biotechnology to food production *www.getintogenes.com.au/index.php?id=1*
(Years 10–12)



New experimental wheat variety developed by CSIRO ©CSIRO

20. Dr Hedley Marston

Dr Hedley Marston (1900–1965) was a biochemist who investigated the radioactive fallout from the British nuclear tests at Maralinga in South Australia. His project tracked the fallout across the continent using the presence of radioactive isotopes in the thyroids of sheep and cattle as well as using devices that monitored the radioactivity in the air. Dr Marston was interested in the relationship between sheep nutrition and the production of high quality wool.

The benefits and consequences of the nuclear testing at Maralinga is a much-debated episode in Australian history. 'Silent storm' is a documentary about Dr Marston's research and its impact and could provide a stimulus for further class discussion.

'Silent Storm', ABC (52:00 min) *www.abc.net.au/aplacetothink/html/silent.htm*
(Years 9–12)

21. Sir Noel Bayliss

Sir Noel Bayliss (1906–1996) was a chemist who was interested in the application of spectroscopy to determine the composition of alunite

clay – an aluminium mineral. He focused on the industrial separation of alumina and potash from the mineral and its conversion to fertiliser and aluminium metal. Sir Noel invented but did not publish the 'Aufbau' form of the periodic table; pioneered use of redox half equations; calculated bond lengths in theory and determined them in practise. He applied the free electron model to dye molecules, and pioneered the use of spectroscopy in industry and mining.

Spectroscopy is an analytical tool used widely to determine the composition and structure of compounds. Introduce students to the different types of spectroscopy at 'Spectroscopy', *Kids.net.au*, *http://encyclopedia.kids.net.au/page/sp/Spectroscopy* **(Years 9–12)**

Older students can explore the spectra of a wide variety of compounds through the Royal Society of Chemistry's SpectraSchool website *www.rsc.org/learn-chemistry/collections/spectroscopy* **(Years 9–12)**

22. Professor Dorothy Hill

Professor Dorothy Hill (1907–1997) was a Queensland geologist who developed a systematic terminology for the description of corals. She mapped the limestone coral fauna of Australia and used this to outline the stratigraphy of the Australian continent. Professor Hill was also the first female President of the Australian Academy of Science in 1970.

Stratigraphy is a tool used by archaeologists to make sense of the layers they are investigating at a particular site. Stratigraphy can be modelled using a stratigraphy cake. For a recipe go to *www.yac-uk.org/yacattack/stratigraphycake* **(Years F–10)**

For interactive activities related to archaeology Worldwide National Archaeology Week has links to materials suitable for a wide range of student abilities and interests *http://archaeologyweek.com/?page_id=27* **(Years F–10)**

23. Dr Adrien Albert

Dr Adrien Albert (1907–1989) was a chemist and pharmacologist renowned for his research in toxicology and the chemistry of heterocyclic compounds. His many contributions included a manual of data on the background, practical measurement and interpretation of Ionisation Constants and the ground breaking Selective Toxicity.

Toxicology is the study of toxic compounds, that is, compounds that may be poisonous. There are many activities for primary school students on the Society of Toxicology website at *www.toxicology.org/kids/grades1_6.asp* **(Years 2–8)**

Station activities to introduce toxicology to upper primary/middle school students can be found at *http://coep.pharmacy.arizona.edu/curriculum/basictoxlab* **(Years 6–10)**

24. Ruby Payne-Scott

Ruby Payne-Scott (1912–1981) was pioneer in radio physics and radio astronomy. She identified different types of solar radiation bursts, and investigated the ionosphere and its impact on visual observations of the universe. In addition Miss Payne-Scott was a passionate and active advocate for women's rights, campaigning against the mandatory dismissal of married women from permanent employment by government organisations.

What is a solar radiation burst? View 'Monster radiation burst from Sun', YouTube (3:32 min) *www.youtube.com/watch?v=MYWH9_XxAoo* **(Years 4–10)**

Why does the Sun have solar flares? How do they impact on us? Visit NASA's Solar Dynamics Observatory to find out *www.nasa.gov/mission_pages/sdo/news/solar-activity.html* **(Years 4–10)**

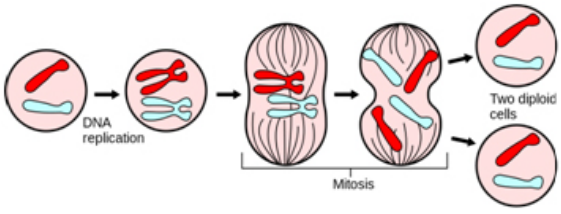
How much solar radiation reaches the Earth daily? Find out at the Bureau of Meteorology's daily solar radiation model description at *www.bom.gov.au/climate/austmaps/about-solar-maps.shtml* **(Years 4–10)**

25. Dr Winifred Curtis

Dr Winifred Curtis (1905–2005) was a pioneer researcher in the field of plant embryology and cytology. One focus of her investigations was the fauna of Tasmania that she catalogued and described in a five-volume work, The Student's Flora of Tasmania. In addition, she reported the first known case of polyploidy in an Australian native plant. This anomaly, which occurs during cell division causes the daughter cells to have an uneven distribution of chromosomes and can be linked to mutations and variations within plant species.

Biographical information about Dr Curtis and her work is available at 'Dr Winifred Mary Curtis – 100 years of botanical research, teaching and travelling', UTAS, *www.utas.edu.au/library/exhibitions/winifred_curtis* **(Years F–10)**

Mitosis is the process in which a cell separates the chromosomes in its cell nucleus into two identical sets. These then become the genetic material of the new cells and nuclei form around them. An interactive animation of mitosis can be found at Cells Alive – Mitosis: An Interactive Animation *www.celsalive.com/mitosis.htm* **(Years 8-12)**



Major events in mitosis

26. Sir Marcus Oliphant

Sir Mark Oliphant (1901–2000) was a physicist whose early investigations using particle accelerators led to the development of the atomic bomb. During World War II Sir Mark was a significant contributor to the Manhattan Project that developed the atomic bombs used to end the War in 1945. Sir Mark was horrified at the impact of these bombs on the civilian population and became a harsh critic of their development and deployment.

Here is a timeline of Australia's nuclear history produced by the ABC: 'Chronology – Australia's Nuclear Political History', Four Corners, *www.abc.net.au/4corners/content/2005/20050822_nuclear/nuclear-chronology.htm* **(Years 9–12)**

For a visual timeline of nuclear weapons development that shows footage of weapons testing and the characteristic mushroom see 'Nuclear Weapons: A Visual Timeline', YouTube (4:14 min) *www.youtube.com/watch?v=gJe7fY-yowk&feature=youtube_gdata_player* **(Years 9–12)**

Mark Oliphant (1939)

27. Professor David Craig AO

In the 1940s, theoretical chemist Professor David Craig (1919 –) applied the newly developed quantum theory

to explain the bonding of aromatic molecules such as benzene. His theoretical explanation of the bonding in these molecules lead to the experimental development of commercially important substances.

Read the transcript of an Australian Academy of Science interview with Professor Craig in which he talks about his research into the molecular bonding in aromatic compounds such as benzene and naphthalene at *http://science.org.au/scientists/interviews/c/dc.html#war* **(Years 11–12)**

28. Dr Douglas Waterhouse

Dr Douglas Waterhouse (1916–2000) was an entomologist who is best known for the invention of the active ingredient in Aerogard, an Australian insect repellent. He oversaw the Australian Dung Beetle Project (1965–1985) that saw the introduction of dung beetles to Australia as a fly control measure. While this was a risky decision because of the threat that the dung beetles could themselves become pests or disrupt the delicate ecological balance, it proved very successful and reduced the population of bush flies by 90%.

Encourage your students to evaluate the impact of introduced species in Australia and contribute to the discussion blog at: 'Introduced species: Friend or foe?', Australian Museum, *http://australianmuseum.net.au/BlogPost/Lifelong-Learning/Introduced-Species-Friend-or-foe* **(Years 8–10)**

The Cane Toad was introduced to Australia to eradicate the cane beetle but now it is a pest. Find out more by watching this video: 'Cane toads', *Behind the News* ABC (3:24 min) *www.abc.net.au/btn/story/s2755966.htm* **(Years 4–6)**

'Cane toad facts and pictures', Australian Geographic, *http://kids.nationalgeographic.com.au/kids/animals/creaturefeature/cane-toad* **(Years 3–6)**

29. Dr Joan Freeman

Dr Joan Freeman (1918–1998) was a nuclear physicist who researched inelastic neutron scattering. Dr Freeman is the only woman to have won the prestigious Rutherford Medal and was the second Australian to do so.

For an interactive tour of atomic particles go to 'The Particle Adventure' website *www.particleadventure.org* **(Years 9–12)**

'Build an atom' *http://phet.colorado.edu/en/simulation/build-an-atom* University of Colorado website, is a simulation allowing students to build atoms and play games to consolidate ideas about the structure of atoms. **(Years 9–12)**

30. Dr Arthur Birch

Dr Arthur Birch (1915–1995) was an organic chemist who developed the Birch reduction process. His research led to the synthesis of the 19-nortestosterone male hormone, the development of first oral contraceptive pill, and paved the way for the synthesis of many other steroids and antibiotics.

Hold a class debate about the impact of the contraceptive pill on women. A fact sheet about the historical development of the contraceptive pill and its impact on Australian society can be found at '50th Anniversary of the Pill in Australia: An Incomplete Revolution', Victorian Women's Trust, *www.vwt.org.au/store/files/1322533344.pdf* **(Years 9–12)**

'Ovulation and the menstrual cycle – Narrated 3D animation', YouTube (4:06

min) explains the relationship between the endocrine system and menstruation. *www.youtube.com/watch?v=WGJ-srGmWeKE&feature=youtube_gdata_player* **(Years 8–12)**

31. Professor Ken Campbell

Queensland born Professor Ken Campbell (1927–) is Australia's leading palaeontologist who published material demonstrating the movement of the ancient continent Gondwanaland before the theory of tectonic plate movement became widely known and accepted. In particular, Professor Campbell studied the fossilised structures of organisms and related these to their function, allowing him to extrapolate possible behaviours of prehistoric organisms. His later research focused on the rates of evolution of organisms.

Fossils are intriguing reminders of the distant past that can stimulate curiosity and interest.

The Australian Museum has a wide range of fossils that can be viewed online at *http://australianmuseum.net.au/Fossils* **(Years F–10)**

The world's oldest fossils were found in the Pilbara region of Western Australia. 'World's oldest fossils found in the Pilbara', Australian Geographic *www.australiangeographic.com.au/journal/worlds-oldest-fossil-found-in-western-australia.htm* **(Years 6–10)**

An interactive exploration of Australian fossils and the organisms they belonged to can be found at OZ-fossils *www.abc.net.au/science/ozfossil* **(Years 4–10)**

Make some fossil models. See 'Best of fossils', CSIRO, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Earth-and-space-sciences-activites/fossil-activity.aspx* **(Years 4–10)**

32. Dr Isobel Bennett

Dr Isobel Bennett (1909–2008) was a marine biologist who researched the coastal waters of Australia and Antarctica. She carried out fieldwork and surveys of many diverse coastal ecosystems, publishing her findings in scientific journals and in books for use by recreational divers. Dr Bennett was involved in the first study of plankton in Australian waters and was a world-recognised expert on the ecosystems of the Great Barrier Reef.

Resources for introducing students to the myriad of organisms that form the Great Barrier Reef can be found at ReefEd, Great Barrie Reef Marine Park Authority, *www.reefed.edu.au* **(Years F–12)**

'Putting a toe in the water', Coastcare Tasmania *www.environment.gov.au/coasts/discovery/teachers/pubs/coastcare.pdf* is a teacher's guide to activities suitable for students from Foundation – Year 12 to investigate their local coastal area. **(Years F–12)**

33. Dr John Cade AO

Dr John Cade (1912–1980) was a psychiatrist who discovered and pioneered the use of lithium to treat bipolar disorder. This was the first medication used to treat a mental illness. Dr Cade was an advocate of a more personal and informal style of care for patients that included the use of group therapy.

Depression is a mental illness that is currently the focus of much debate and interest. What is depression? How can you recognise it in yourself and others? How can you help? How can you get help? This topic can be of great interest especially to adolescents. Ask students to research the topic using websites such as those listed

below and to develop a set of warning signs to identify the onset of depression in themselves and others. Then ask them to make an action list of strategies they can use to move out of depression.

Youth Beyond Blue *www.youthbeyondblue.com* **(Years 7–12)**

Headspace *www.headspace.org.au* **(Years 7–12)**

Black Dog Institute *http://blackdoginstitute.org.au/public/depression/inteenageryoungadults.cfm* **(Years 7–12)**

34. Professor Frank Fenner

Professor Frank Fenner (1914–2012) was a virologist whose research had two major impacts on both Australian and global society. He oversaw the use of smallpox vaccine worldwide which led to the disease being reduced from plagues to small isolated outbreaks until finally the world was declared smallpox free in 1980. Professor Fenner developed and oversaw the use of the myxoma virus to eradicate feral rabbits that had reached plague numbers and were devastating the Australian environment.

Invasive species in Australia have often found niches in the native ecosystems and with no natural predators present have exploited this to become threats to the native fauna and flora. Ask students to evaluate the impact of invasive species using a Plus/Minus/Interest chart and write an information pamphlet to raise public awareness. Some websites for use as starting points include:

'Feral animals in Australia', Department of Sustainability, Environment, Water, Population and Communities, *www.environment.gov.au/biodiversity/invasive/ferals* **(Years 7–12)**

Feral.org.au *www.feral.org.au* **(Years 7–10)**

'Feral animal control', Australian Wildlife Conservancy *www.australianwildlife.org/Conservation-Programs/Feral-Animal-Control.aspx* **(Years 7–12)**

Students could interview local people about the impact the invasive species and produce a video or podcast of their findings.

35. Dame Kate Campbell OBE

Dame Kate Campbell (1899–1986), a specialist in children's diseases, identified the link between pure oxygen and infant blindness. She pioneered neonatal intensive care and developed tests for the reflexes and neurological functions of newborn full-term and premature babies. In particular, Dame Kate championed the role of maternal bonding and the benefits of family care to premature babies' wellbeing and health.

The development of a baby from conception to birth is an intricate process as shown in the videos below.

'Real footage of developing baby/embryo/foetus', YouTube (5:29 min) *www.youtube.com/watch?v=gaK0VPV9NlE* **(Years F–12)**

'The baby in the womb' YouTube (3:24 min) *www.youtube.com/watch?v=CP-PkXe8KUg0* **(Years F–12)**

'Development of foetus', YouTube (4:29 min) *www.youtube.com/watch?v=aR-Qa_LD2m4* **(Years F–12)**

36. Sir Alan Walsh

Sir Alan Walsh (1916–1998) was an English physicist who made Australia his home in 1946 when he was appointed to the CSIR Division of Industrial Chemistry. Sir Alan was interested in finding a way to identify very small concentrations of metallic elements accurately

using Atomic Emission Spectroscopy (AES). While working in his garden one morning he suddenly realised that the best way to do this was not to measure the light emitted by elements, but rather the light absorbed by the element. He reconfigured his atomic emission spectrometer to measure the absorption of light by a very low concentration of sodium ions and found that he could measure the concentration of sodium atoms very accurately. Sir Alan's discovery led to the development of the atomic absorption spectrophotometer.

Atomic Emission Spectroscopic analysis is based on the observation of light emitted by atoms of elements when they are placed in a flame. The atoms absorb energy from the flame and are said to become 'excited'. When the atoms return to their normal state, they emit energy in the form of light. By measuring the wavelengths of this light, scientists can identify which element is present. Atomic absorption spectrometry is based on observing those wavelengths that are missing from light when it passes through a sample. AES is an analytical tool that is used in fields such as mining, agriculture, medicine and manufacturing industries.

'Lab Emission Spectroscopy (Flame Tests)' – a worksheet for an experiment using diffraction grating spectroscopy to observe emission spectra of elements. Go to *www.greenwichschools.org/page.cfm?p=2214* and scroll down to Unit 05 Electrons and Electromagnetism. The worksheet is in this unit. **(Years 8–12)**

'Neon Lights and Other Discharge Lamps', Colorado University, *http://phet.colorado.edu/en/simulation/discharge-lamps* is a simulation that allows students to model bombarding atoms with electrons and observe their characteristic spectra.

A range of interactive computer programs developed by the Visual Quantum Mechanics project in the USA to introduce quantum physics to non-science students, can be found at 'Explorations of the Quantum World for Non-science students', Kansas State University, *http://phys.educ.ksu.edu* **(Years 8–12)**

37. Dr David de May Warren

Dr David Ronald de May Warren (1925–2010) developed the black box after being involved in the investigation of the world's first commercial jet airliner crash in 1953. He used magnetic recording media in combination with other instruments to produce a reusable device that has been instrumental in determining the cause of many air crashes.

Ask students to construct a timeline of the development of the Black Box flight recorder and evaluate the impact it has had on airplane safety. Use these websites as a starting point:

'Black box flight recorder invented in Melbourne', ABC (includes a video) *www.abc.net.au/archives/80days/stories/2011/10/27/3367965.htm* **(Years 8–12)**

'Black box flight recorder' Powerhouse Museum, *www.powerhousemuseum.com/australia_innovates/?Section_id=1080&article_id=10084&behaviour=view_article* **(Years 8–12)**

'Black boxes', TIME Magazine, *www.time.com/time/magazine/article*/0,9171,1909619,*00.html* **(Years 8–12)**

The digital flight data recorder and cockpit voice recorder (black boxes) developed by Dr Warren, Melbourne. Loui Seselja, National Library of Australia, nl39475g-ls118

38. Sir Ronald Nyholm

Sir Ronald Nyholm (1917–1971) was an inorganic chemist who with Professor Ronald Gillespie used quantum mechanics to develop the Valence Shell Electron Pair Repulsion theory (VSEPR theory). He applied this to explain the bonding and structure of the coordination complexes of transition metals he had recently synthesised. Sir Ronald was particularly interested in compounds of platinum, nickel, iridium, rhodium and osmium.

For a practical where the colours of transition metal complexes are observed see 'Properties of the transition metals and their compounds', Royal Society of Chemistry, *www.rsc.org/learn-chemistry/content/filerepository/CMP/00/000/542/cce-88.pdf?v=1369192301538* **(Years 10–12)**

'Molecule Shapes', from University of Colorado, is a simulation in which students build models of molecules using VSEPR theory *http://phet.colorado.edu/en/simulation/molecule-shapes* **(Years 9–12)**

39. Dr Yvonne Aitken

Dr Yvonne Aitken (1911–2004) was an agricultural scientist who researched the impact of changes in climate on different crops. Her work led to an understanding of how plants respond to changes in temperature and light that has been used to identify and develop better crop and pasture species for use in Australia. In one study Dr Aitken collected data on crops sown in different climates for comparison to the same species grown in Melbourne. This study allowed agricultural scientists to identify and explain how the genetic makeup of each plant species controls its ability to reproduce and grow in different climates and seasons.

What are the different factors that impact on plant growth? Choose a quick growing plant like mustard, cress, radishes or mung beans and get your students to try to grow them in different places in the classroom or school. While they are waiting, use a simulation on the internet to explore how changes to different variables impact on plant growth. 'Plant force', *http://puzzling.caret.cam.ac.uk/pregame.php?game=16* **(Years 1–10)**

There are a selection of learning objects on growing plants at *http://topmarks.co.uk/interactive.aspx?cat=64* **(Years 3–7)**

Listen to a 2001 interview with Dr Aitken in 'Interviews with Australian Scientists' by the Australian Academy of Science *http://science.org.au/scientists/interviews/a/ya.html* **(Years 6–10)**

40. Dr Charlotte Anderson

Dr Charlotte Morrison Anderson (1915–2002) was a pioneer in the field of paediatric gastroenterology. She developed tests to differentiate between coeliac disease and cystic fibrosis. Dr Anderson investigated the role of gluten in coeliac disease and developed gluten free diets to manage the disease. She introduced the use of inhalants and chest physiotherapy for children with cystic fibrosis leading to an increase in their survival rate.

Compare the gluten content of different flours: 'Goodness Gracious! Great Balls of Gluten!', Exploratorium, *www.exploratorium.edu/cooking/bread/activity-gluten.html* **(Years 6–10)**

Make play dough with different flours and compare the results using this recipe: 'Playdough – For Playing and No Cooking Required', Healthykidz, *www.healthykidz.com.au/recipes/playdough-for-playing-no-cooking-required* **(Years F–6)**

41. Dr Saul Wiener AM

Dr Saul Weiner (1928–2010) was a physician scientist who developed antivenins for the Redback spider and the world's first marine antivenin for the Stonefish. His later interest in allergies and immunology led to the discovery of a genetic basis for Fragile-X syndrome.

'CSL antivenoms', Powerhouse Museum, *www.powerhousemuseum.com/australia_innovates/?behaviour=view_article&Section_id=1030&article_id=10026* **(Years 8–10)**

The Venom Patrol (*www.venompatrol.org/index.html*) has integrated units based on ACARA syllabi to teach students about Australia's venomous animals and antivenins **(Years 3–10)**

Redback spider, William, Flickr *CC BY 2.0*

Stonefish, walknboston, Flickr *CC BY 2.0*

42. Dr Ian McWilliam AO

Ian McWilliam (1933 –) is an Australian physicist interested in improving the accuracy of gas chromatography especially when it was being used to determine the composition of petroleum. He designed several devices that ionised compounds as they exited the gas chromatograph, allowing the identification of organic molecules in very low concentrations. The Flame Ionisation Detector is used in the petroleum and petrochemical industries, and is also essential to the detection and control of pollution emissions. It is also used in medical research, pharmaceutical and biochemical research as it can detect concentrations as low as one part per ten million.

One of the processes used by analytical chemists to separate liquid or gas mixtures into their components is chromatography. In this process, the mixture passes through a solid medium using a solvent. The medium and solvent is chosen specifically to allow different components of the mixture to move at different rates through the medium. A simple enough process in theory, but it can be complex in reality.

Try this: 'Experiment – Ink chromatography', ExperiMENTALS ABC, *http://abc.net.au/science/experimentals/experiments/episode20_1.htm* **(Years 6–10)**

Watch this video from the Royal Society of Chemistry demonstrating gas chromatography 'AQA GCSE C2 – Gas Chromatography', YouTube (5:44 min) *http://youtube.com/watch?v=8J8w9qai330* **(Years 6–10)**

43. Professor Bernard Mills AC

Professor Bernard Mills (1920–2011) was a radio astronomer who designed and implemented the Mills Cross Antennae radio telescope near Bungendore. This operated for 11 years cataloguing over 12,000 radio sources and many pulsar surveys. This radio telescope has since been reconfigured and currently is used as a pathfinder for the Square Kilometre Array telescope.

For a myriad of activities on astronomy see 'Australian Backyard Astronomy', National Library of Australia, www.nla.gov.au/education/astronomy **(Years 5–10)**

Astronomy Activities4kids contains a list of low cost activities for children throughout Australia www.activities4kids.com.au/ActivityResults.aspx?Activity=83 **(Years 5–10)**

Looking for stars? Try 'Skyview', the internet's virtual telescope http://skyview.gsfc.nasa.gov/cgi-bin/titlepage.pl **(Years 5–10)**

44. Professor Gordon Ada

Professor Gordon Ada (1922–2012) was a microbiologist whose research identified the viral cause of influenza. In 1962, he determined that antigens and not antibodies caused immune responses. Professor Ada was also active in the World Health Organisation and developed vaccine candidates for HIV-AIDS virus.

Find out how viruses evolve and spread

'Pandemic 2' http://pandemic2.org is a game simulating the spread of viral diseases throughout the world population. **(Years 8–10)**

'Ebola – The Plague Fighters' is a class modelling activity demonstrating how viral diseases spread www.pbs.org/wgbh/nova/education/activities/2304_ebola.html **(Years 8–10)**

45. Professor Bill Compston

Professor Bill Compston (1931 –) is a geophysicist who was one of the principle investigators who dated Lunar rock samples collected by Apollo 11. Professor Compston developed the Sensitive High Resolution Ion Micro Probe or SHRIMP that was used to date the world's oldest mineral in Western Australia at 4.18 billion years old.

Geologists use the radioactive decay of certain elements to date rocks and minerals found in the Earth's surface. To find out how, watch the video 'Radiometric dating', Science Channel (2:53 min) http://science.discovery.com/tv-shows/greatest-discoveries/videos/100-greatest-discoveries-radiometric-dating.htm **(Years 9–12)**

46. Professor Ronald Bracewell

Ronald N Bracewell (1921–2007) was a physicist, mathematician and radio astronomer who developed and used microwave radar to study the ionosphere. His work also contributed to medical imaging such as brain scans. Professor Bracewell developed the microwave spectroheliograph and used it to generate daily temperature maps of the Sun. He also investigated cosmic background radiation, developed interferometers for use in space on probes and space stations.

Many households – and some schools – have microwave ovens. Try some microwave science:

'Monster Mallows', Science of Cooking, http://exploratorium.edu/cooking/candy/activity-mallows.html **(Years F–6)**

Use a microwave to calculate the speed of light: 'Hot chocolate', Science by email, www.csiro.au/helix/sciencemail/activities/hotchocolate2.html **(Years 10–12)**

'Microwave experiments at school', Science in school, www.scienceinschool.org/2009/issue12/microwaves **(Years F–10)**

47. Professor Peter Bishop

Professor Peter Bishop (1917–2012) was a physician who specialised in neurophysiology. He investigated the electrical stimulation of the optic nerve and how an eye forms an image. Professor Bishop and his colleagues developed a mathematical model of the visual system of a cat. He became interested in the ability of people to see in three dimensions, and found that nerve impulses from the two eyes go back to the same cell in the brain.

Here are some fun activities to try:

'How to make a functional eye model', eHow, *www.ehow.com/how_7828732_make-functional-eye-model.html* **(Years 5–12)**

'Blind spot', Science by email, CSIRO, *www.csiro.au/helix/sciencemail/activities/BlindSpot.html* **(Years 5–10)**

'Lasting colour', Science by email, CSIRO, *www.csiro.au/helix/sciencemail/activities/lastingcolours.html* **(Years 5–10)**

'Corner of your eye', Science by email, CSIRO *www.csiro.au/helix/sciencemail/activities/peripheral.html* **(Years 5–10)**

'Look into your eye', Science by email, *www.csiro.au/helix/sciencemail/activities/eyeblood.html* **(Years 5–10)**

48. Professor Bruce Holloway

South Australian Professor Bruce Holloway (1928 –) is a geneticist whose initial work focused on the bacteria Pseudomonas aeruginosa . His work has contributed to the treatment of lung diseases in humans and to treatment of bacterial wilt in tomato and potato crops. The molecular genetic techniques developed by Professor Holloway have been applied to crops in tropical areas of Africa, Asia, South and Central America.

What is gene technology? What impacts could it have on our society and environment? Is it beneficial or risky? This is a great area for students to evaluate and debate the pros and cons of genetic technology. To get them started send them to find out about genes and innovations in gene technology in Australia. Try:

'Gene technology', CSIRO *www.csiro.au/resources/Gene*-technology **(Years 10–12)**

'Synthetic meat' RiAus Scimations (2:22 min) *http://riaus.org.au/all-programs/scinamations* **(Years 10–12)**

'Teacher Notes: Synthetic Biology', RiAus, *www.yumpu.com/en/mobile/view/5909475* **(Years 10–12)**

Read the transcript of an Australian Academy of Science interview with Professor Bruce Holloway and choose some of the activities for your students *http://science.org.au/scientists/interviews/h/notes_bh.html* **(Years 8–12)**

49. Dr David Robinson

Dr David Robinson (1939–2010) made pioneering contributions to the use of diagnostic ultrasound. From an engineering background, Dr Robinson became interested in alternatives to the use of x-rays in diagnosing abnormalities in developing foetuses. In partnership with George Kossoff he built a water-based ultrasound scanner and in 1962 recorded the first ultrasound images of a foetus. Dr Robinson developed criteria for the use of ultrasound imagery in pregnancy, and in the 1970s expanded the use of ultrasound imagery to other clinical diagnoses.

Find out how ultrasound works: 'How ultrasound works', University of Toronto, *www.physics.utoronto.ca/~jharlow/teaching/phy138_0708/lec04/ultrasoundx.htm* **(Years 9–12)**

How does ultrasound see your body? Have a look at 'Ultrasound image gallery'*www.ultrasound-images.com* **(Years 8–12)**

Medical Ultrasound Scanner By Daniel W. Rickey 2006 *CC BY-SA 3.0*

50. Professor Alan Parker

Professor Alan Parker (1933–1982) was one of Australia's most distinguished theoretical chemists. He was passionately interested in the effect of solvents on reactions and proved that some properties originally assigned to solute species were actually a result of the interaction of the solute with the solvent it was dissolved in. Professor Parker applied this knowledge to many areas including electrochemistry leading to the development of zinc-bromine batteries.

Electrochemical batteries provide us with a mobile source of electrical current for use in appliances such as mobile batteries, radios, camp fridges and cars. Students of all ages can take the 'Lemon battery challenge', CSIRO Science by email, *www.csiro.au/helix/sciencemail/activities/lemonbattery.html* **(Years 9–12)**

For an atomic level description of how electrochemical cells work, watch the video 'Cu-Zn Electrochemical Cell Animation', You Tube (1:55 min) *www.youtube.com/watch?v=J1IjxodF9_g* **(Years 9–12)**

Lemon battery, Travis V, Flickr *CC BY 2.0*

51. Arthur Bishop AM

Arthur Bishop (1917–2006) was an innovative engineer whose work focused on finding ways to improve the steering in aircraft and cars. He was responsible for a series of inventions including hydraulically powered steering and variable-ratio steering. In the 1970s, he did what the experts had declared impossible and developed a rack and pinion steering that not only improved steering and vehicle response times but was also economically feasible to mass-produce. Not content to confining his ideas to automobiles, Arthur Bishop contributed solutions to technology issues in the aerospace, biomedical and telecommunications industries.

Try these resources for teaching your students about simple machines:

'Simple Machines', FTfs, *www.forteachersforstudents.com.au/Engineers/SimpleMachines/index.php* **(Year 7)**

'Simple machines', CSIRO, *www.csiro.au/Portals/Education/Teachers/Incursions-and-excursions/education-centres/Education-ACT/Simple-Machines.aspx* **(Years 5–8)**

'Simple machines', Edheads *www.edheads.org/activities/simple*-machines **(Years 5–8)**

52. Helen Brookes

Helen Brookes (1917–2008) was an entomologist who identified and catalogued Australian scale insects. Her work enabled farmers and orchardists to correctly identify pests in their crops, which was especially important when crops were exported to other countries. Helen Brookes was a world-recognised expert in her field and she generously donated her specimen collection to the Australian National Insect Collection on retirement.

Don't know which bug is which? Visit 'What Bug Is That?', CSIRO, *http://anic.ento.csiro.au/insectfamilies* **(Years F–10)**

Find out about collecting and identifying bugs in your backyard with 'Backyard Biodiversity bugs', CSIRO, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Backyard-Biodiversity/backyard-biodiversity-bugs.asp* **(Years F–6)**

53. Dr John Phillips

Dr John R Phillips (1927–1999) was a soil physicist and mathematician whose research led to the understanding of the movement of water, energy and gases through the soil. Dr Phillips designed and used mathematical models to explain and predict the infiltration of water into soil. He also investigated how heat and mass are transferred through soil, and how water travels through transpiration paths from the soil to the atmosphere.

Try these soil investigations:

'Backyard Biodiversity salinity experiment', CSIRO, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Backyard-Biodiversity/Backyard-Biodiversity-salinity-experiment.aspx* **(Years 4–10)**

'Simple soil experiments for schools', Eco Friendly Kids, *www.ecofriendlykids.co.uk/simple-soil-experiments-for-schools.html* **(Years F–12)**

'Science projects for kids: soil experiments', TLC, *http://tlc.howstuffworks.com/family/science-projects-for-kids-soil-experiments1.htm* **(Years F–12)**

'Soil for Gen Z: Can you grow things in sand?', Soilduck, *www.soilduck.com* **(Years F–12)**

54. Professor Donald Metcalf AC

Professor Donald Metcalf (1929 –) is a medical researcher who pioneered research into the control of blood cell formation. His research into the hormones that stimulated the growth of white blood cells revolutionised the understanding of many disease of blood cells and their treatment. Although he retired in 1996 he is still an active researcher at the Walter and Eliza Hall Institute.

A transcript of the 'Australian Biography interview with Professor Donald Metcalf' can be found at *www.australianbiography.gov.au/subjects/metcalf/intertext6.html*. **(Years 8–12)**

Teacher notes to accompany the Australian Biography Series 11 interview with Professor Donald Metcalf can be found at *www.filmaust.com.au/australianbio11/TN_DMETCALF.pdf*

55. John Paul Wild AC CBE

J. Paul Wild (1923–2008) was a physicist who served in the navy as a radar officer during World War II. Radar technology was in its infancy and was often jammed by a mysterious source of

'noise' or interference. Paul Wild investigated the source of this noise – the Sun. After the war he led a team of solar physicists investigating the emissions from the Sun using the radio heliograph – a huge purpose specific radio telescope located at Culgoora in northern NSW. John Wild was an innovator who designed a microwave landing system for aircraft called Interscan that was accepted in 1978 as the global standard for safely landing aircraft.

Try these activities:

'Build a solar viewer', CSIRO,*www.csiro.au/Outcomes/Understanding-the-Universe/Tracking-spacecraft/solar-viewer.aspx* **(Years 4–10)**

'Tracing the path of the Sun', CSIRO, *www.csiro.au/en/Outcomes/Understanding-the-Universe/Tracking-spacecraft/Tracing-the-path-of-the-Sun.aspx* **(Years 4–10)**

'Tracking spots on the Sun', CSIRO, *www.csiro.au/en/Outcomes/Understanding-the-Universe/Operating-our-radio-telescopes/tracking-spots.aspx* **(Years 4–10)**

56. Dr Basil Hetzel

Dr Basil Hetzel (1922 –) is a medical researcher who found that iodine deficiency caused thyroid disorders leading to cretinism and goitre. He also demonstrated that adding iodine to the diet prevented these illnesses. A direct result of his discovery is the international addition of iodine to table salt.

'Grow your own salt crystals', Science Kids, *www.sciencekids.co.nz/projects/saltcrystals.html* **(Years 4–10)**

'National Chemistry Week – Experiments – Removing Iodine for Iodised Salt' Chemical Institute of Canada, *http://ncwsnc.cheminst.ca/experiments/eiodine.html* **(Years 9–10)**

57. Dr Henry Harris

Dr Henry Harris (1925 –) is a medical researcher who pioneered research into the link between cancer and human genetics. Based in England, Dr Harris' contributions included developing basic techniques for investigating and measuring genes in human chromosomes, identifying that most nuclear RNA does not carry genetic coding information and importantly demonstrating the existence of genes that have the ability to suppress the development and growth of malignant cancer cells.

'DNA model', CSIRO, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Biological-sciences-activities/dna-model-activity.aspx* **(Years 8–12)**

'Modelling DNA Replication', Biology Junction, *http://www.biologyjunction.com/dnareplication_lab.htm* **(Years 8–12)**

58. Professor David Curtis

Professor David Curtis (1927 –) is a pharmacologist and neurobiologist whose area of study focused on understanding how messages are transmitted between cells using chemicals. In particular, he explored the role of amino acids in this process both in the spinal cord and in neurones elsewhere. Professor Curtis is also an advocate for the humane treatment of animals used in experiments.

None of us are born with a 'How to' guide for our brain and nervous system. Research into its structure and function continues to be a major focus of medical scientists. Some activities to encourage students to develop an understanding of the nervous system and brain include:

'Craft a neuron', CSIRO Science by email, *http://csiro.au/helix/sciencemail/activities/NeuronCraft.html* **(Years 8–12)**

'Experiment –Test your reflexes', Experi-MENTALS, *www.abc.net.au/science/experimentals/experiments/episode11_4.htm* **(Years F–10)**

'Brain Structure and function', Neuroscience Research Australia, *http://neura.edu.au/research/themes/brain-structure-function* **(Years 8–12)**

59. Professor Ian Ross

Ian Gordon Ross (1926–2006) was an organic chemist interested in the electronic spectroscopy of benzene and its derivatives. This led to an increased understanding of dipole moments within molecules. In addition, Professor Ross was one of the first to apply quantum mechanics to accurately calculate electron configuration interactions between molecules. Professor Ross made several modifications to infrared spectrometers that have made it much easier for chemists to understand the interactions between different molecules or different parts of the same molecule. This is important, especially when chemists are investigating how drug molecules interact, and how the body synthesises different compounds such as hormones, proteins and DNA.

Try these electrostatic experiments:

'Bendy water', Science by email, CSIRO *www.csiro.au/helix/sciencemail/activities/WaterBend.html* **(Years 4-10)**

'Franklin's bells', Science by email, CSIRO, *www.csiro.au/helix/sciencemail/activities/franklinsbells.html* **(Years 6-10)**

'Balloons and static electricity', University of Colorado, *http://phet.colorado.edu/en/simulation/balloons* is a simulation investigating static electricity. **(Years 6-10)**

60. Dr Roger Norse

One resource Australia has in abundance is light from the Sun, so it makes sense that many of our brightest thinkers have looked for ways to harness this free energy for everyday use. D. Roger 'Neil' Morse (1914–2003) was an engineer who lead research into the use of air conditioning and refrigeration to improve the living and working conditions of Australians. In 1974 he headed up the Solar Energies Studies department of the CSIRO where he focused on research into harnessing solar energy for use both domestically and industrially. In this role Dr. Morse designed and manufactured solar heating systems for use in house hold water heaters and industrially in food processing plants and milk pasteurisation plants.

Build a 'Pizza box solar oven', Science by email, CSIRO, *www.csiro.au/helix/sciencemail/activities/solaroven.html* **(Years 4–12)**

Build a 'Model solar hot water heater', Charles Edison Fund, *www.charlesedisonfund.org/Experiments/HTMLexperiments/Chapter2/2-Expt1/p1.html* **(Years 4–12)**

'100 facts about solar at CSIRO', solar@CSIRO, *http://csirosolarblog.com/tag/100-facts-about-solar-at-csiro* **(Years 8–12)**

61. Bill Mollison

Bill Mollison (1928 –), the father of permaculture, is a biologist and environmentalist. Mr Mollison was very concerned at the degradation of the natural environment he saw, and developed an integrated system of agricultural, ecological, horticultural and architectural principles to address this. A strong advocate for the importance of biodiversity in the agricultural and

domestic sector as well as in the 'wild,' Mr Mollison also supports the use of school and household gardens as tools to educate children about biodiversity.

Interested in starting a household or school garden? Find teacher resources at 'Tools for Teachers curriculum resource' Kitchen Garden Foundation, *www.kitchengarden-foundation.org.au/index.php?nodeId=128* **(Years F-10)**

'Teachers' kit – Biodiversity for kids', NSW Department of Environment and Heritage, *www.environment.nsw.gov.au/edre-sources/TeachersKitBiodiversity.htm* **(Years F-10)**

An interview transcript from ABC Rural Legends: Bill Mollison can be found at *www.abc.net.au/site-archive/rural/legends/stories/4_1.htm* **(Years 8-10)**

Bill Mollison, Nicolas Boullosa, Flickr *CC BY 2.0*

62. Professor Ted Ringwood

Professor Ted Ringwood (1930–1993) was an experimental geophysicist and geochemist who investigated the properties of germinates and silicates. Professor Ringwood led a team that developed synroc – a synthetic rock designed to store radioactive waste safely. During the formation of the synroc, nuclear waste is mixed with other minerals and then heated to produce a ceramic material. This does not neutralise the waste, but is a superior way of storing it and ensuring that it does not leach into the environment.

'Rocky road – conglomerate rock', Science by email, CSIRO *www.csiro.au/helix/sciencemail/activities/RockyRoad.html* **(Years 4–8)**

'Edible rock cycle activities for kids', eHow, *http://ehow.com/info_8558092_edible-rock-cycle-activities-kids.html* **(Years 4-8)**

'Thirsty rocks', Science by email, CSIRO *www.csiro.au/helix/sciencemail/activities/ThirstyRocks.html* **(Years 4-8)**

63. Professor Ken Freeman

Professor Ken Freeman (1940 –) is an astronomer whose research has focused on the formation and dynamics of galaxies and globular clusters. He is particularly interested in the problem of dark matter in galaxies and was one of the first astronomers to identify the high proportion of dark matter in spiral galaxies. Professor Freeman's observations about the brightness of the surface of disc galaxies led to the formulation of the Freeman Law. He won the 2012 Prime Minister's Prize for Science.

Follow the life of a disc galaxy in this computer animation from NASA: 'Computer Model Shows a Disk Galaxy's Life History', YouTube (2:17 min) *www.youtube.com/watch?v=_Ssc1GsqHds* **(Years 5–10)**

'Minute Physics: What is dark matter?', YouTube (1:09 min) *www.youtube.com/watch?v=Af0_vWDfJwQ&feature=youtube_gdata_player* **(Years 10–12)**

64. Dr Robin Bedding

Dr Robin Bedding (1940 –) is a zoologist and entomologist who pioneered the use of nematodes to control insect pests. His work in controlling the Sirex wasp has had a huge impact on the forestry industry in Australia. Dr Bedding and his team have developed

processes for mass producing specific nematodes for use in field trials and commercially in Australia and overseas.

What are nematodes? Find out at 'An online introduction to the biology of animals and plants – Roundworms/Nematodes', Fulton Montgomery Community College, *http://faculty.fmcc.suny.edu/mcdarby/animals&plantsbook/animals/04-Roundworms.htm* **(Years 7–10)**

'Natural solutions', Gardening Australia ABC, *www.abc.net.au/gardening/stories/s2262098.htm* **(Years 3–10)**

'Soil biology basics – Nematodes', NSW DPI, *www.dpi.nsw.gov.au/__data/assets/pdf_file/0015/41640/Nematodes.pdf* **(Years 7–10)**

Sirex Woodwasp (Sirex noctilio), Michaellbbecker, CC *BY-SA 3.0*

65. Professor Brian Anderson

Professor Brian Anderson (1941 –) is an electrical engineer interested in computers who has made many significant contributions to signal processing and control, circuits, sensor networks and robotics. Professor Anderson has also researched navigation and position fixing, networking and communications and wireless communications.

For experiments to encourage your students' interest in current electricity visit:

'Electric experiments', The Surfing Scientist, ABC *www.abc.net.au/science/surfingscientist/pdf/lesson_plan11.pdf* **(Year 6)**

'Electric circuits', Digital Education Revolution, NSW DEC, *www.curriculumsupport.education.nsw.gov.au/digital_rev/science/stage5/eleccircuits/index.htm* **(Year 6)**

'Circuit construction kit (AC + DC), Virtual Lab', University of Colorado, *http://phet.colorado.edu/en/simulation/circuit*-construction-kit-ac-virtual-lab **(Years 6-12)**

'Electricity teaching resources', Woodlands Science Zone, *http://resources.woodlands-junior.kent.sch.uk/revision/science/electricity.htm* **(Year 6)**

66. Dr Paul Fraser

Dr Paul Fraser is an atmospheric chemist who has researched the impact of greenhouse gases on climate change. He was one of founding scientists at Cape Grim Atmospheric Baseline Station. Dr Fraser's research has been instrumental in producing an accurate record of greenhouse gas fluctuations in the southern hemisphere. His research is currently focused on quantifying greenhouse emissions and their capture and storage, and assessing its impact on the environment.

'CarbonKids', CSIRO Education, *www.csiro.au/carbonkids* has resources about carbon dioxide emissions and their impact. **(Years F–12)**

'Australian greenhouse calculator', EPA Victoria, *www.epa.vic.gov.au/AGC/home.html* **(Years 7–10)**

For ATSE resources on greenhouse gas emissions and alternative fuels from the STELR project go to 'Student portal', The STELR Project, *http://stelr.org.au/student-portal/* **(Years 7–10)**

67. Professor Graeme Clark

Professor Graeme Clark (1935 –) is an Australian doctor whose research into deafness led to the development of the

'Bionic Ear' – a multiple-channel Cochlear Implant. Professor Clark's research focused on stimulating the auditory nerve to reproduce the coding of sound, by passing damaged or underdeveloped tissue in the ear. Professor Clark's research has brought sound to many deaf people throughout the world.

Try some 'Experiments on sound', Kill o' the Grange National School, *http://homepage.eircom.net/~kogrange/sound_experiments.html* **(Years 4–10)**

Find out about the anatomy of the human ear and how the ear works: '3D Human Ear' YouTube (3:19 mins) *www.youtube.com/watch?v=RyVOKTgvuDM* **(Years 8–10)**

For interactive games and activities on sound see: 'Sounds', Woodlands Junior School, *http://resources.woodlands-junior.kent.sch.uk/revision/science/sounds.html* **(Years 4–8)**

Cochlear implant

68. Professor Fiona Stanley

Professor Fiona Stanley (1946 –) is an epidemiologist who has a passionate interest in the health of Aboriginal peoples. In particular she has campaigned to raise awareness of the impact of maternal health on the developing foetus in outback, regional Australia. Her work used population data to determine causes for cerebral palsy, and the role of folic acid in the prevention of spina bifida, and to suggest strategies to reduce their occurrence. The goal of Professor Stanley's research has been to raise the quality of life for children and adolescents, and she has lead teams investigating asthma and allergies, cancer, birth defects, mental health, childhood disabilities, infectious diseases and perinatal epidemiology.

Professor Stanley was declared a National Treasure for her research. Find out more about Professor Stanley and her work using the following websites:

'Interviews with Australian Scientists: Professor Fiona Stanley', Australian Academy of Science, *http://science.org.au/scientists/interviews/s/fs.html* **(Years 8–12)**

'Fiona Stanley', The Conversation', *http://theconversation.com/profiles/fiona-stanley-16277/profile_bio* **(Years 8–12)**

69. Professor Jennie Brand-Miller

Professor Jennie Brand-Miller (1952 –) holds a Personal Chair in Human Nutrition in the School of Molecular Biosciences at the University of Sydney. Her research into the relationship between nutrition and health has led to the development of the glycemic index used by diabetics to manage their diabetes. Professor Brand-Miller has a special interest in the field of evolutionary nutrition and the impact of changes in diet on the health of Aboriginal peoples.

Professor Brand-Miller's research and its use is the subject of an article on the ABC's News in Science website: 'Nutritionist recognised for pioneering work', ABC Science, *www.abc.net.au/science/articles/2011/06/13/3242362.htm* **(Years 8–10)**

A transcript of an interview with Professor Brand Miller for the ABC's Talking Heads can be found at *www.abc.net.au/tv/talkingheads/txt/s2511619.htm*

Benedict's test is used to determine if a food contains sugar. It can also be used to determine if there is sugar present in the urine of diabetics. A video of a Benedict's test procedure and results using bread, grapefruit juice and nuts can be viewed at 'Benedict's test for reducing sugars', YouTube (0:50) *www.youtube.com/watch?v=SYgsxZg1330&feature=youtube_gdata_player* To use this as a stimulus for students to design their own investigation, allow students to view the video and generate a class flow chart for the procedure. Ask students to translate this into a stepwise method for their own experiments **(Years 8–10)**

70. Professor Collin Sullivan

Professor Collin Sullivan (1945 –) is a physician whose research focuses on sleep and sleep disorders. He is interested in the changes on airway muscle tone of sleeping and how the mechanism of breathing changes. Professor Sullivan developed the Continuous Positive Air Pressure mask that has been used to help babies, who are at risk of Sudden Infant Death Syndrome, to breathe.

Did you know that:

- over 10% of students are sleep deprived?
- sleep deprivation has the same impact as consuming alcohol on your nervous system?
- we dream every night but most of us cannot recall our dreams on waking?

Resources for teaching students about the importance of sleep can be found at:

'Unit: ZZZZzzzWorld – Exploring the science of sleep', UT Health Science Centre, *http://teachhealthk-12.uthscsa.edu/curriculum/sleep/sleep.asp* **(Years 8–10)**

'The science of sleep and daily rhythms', BioEd, *http://www.nsbri.org/default/Documents/EducationAndTraining/TSO_Sleep.pdf* **(Years 8–10)**

'Sleep, sleep disorders and biological rhythms', National Institutes of Heath, *http://science.education.nih.gov/supplements/nih3/sleep/default.htm* **(Years 8–10)**

71. Professor Adrienne Clarke AC

Professor Adrienne Clarke AC (1938 –) is a biologist and medical scientist who has provided critical insight to the biochemistry and genetics of flowering plants, their reproduction, and their growth. Professor Clarke's research has led to industrial applications for next-generation control of insect pests and fungal disease of crops.

'Flower power', CSIRO, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Biological-sciences-activities/flower-power-activity.aspx* Follow the instructions to dissect a flower and name all its parts. **(Years F–8)**

'Flower power!' CSIRO, *www.csiro.au/Portals/Education/Programs/Double-Helix-Science-Club/ScientrifficMain/scientriffic-flower-power.aspx* Watch the way water can move through plants in this video clip (0:17 min). **(Years F–8)**

'Games and activities about plants, Woodlands Junior School, *http://resources.woodlands-junior.kent.sch.uk/revision/science/living/plants.html* **(Years F–8)**

72. Professor Amanda Lynch

Professor Amanda Lynch is a meteorologist and environmental scientist who developed global and regional models of climate change, weather prediction models and statistical models. Professor Lynch is an advocate of indigenous peoples and the impact of climate change on their cultural heritage. She is currently involved in investigating the

impacts of climate change such as floods, bushfires and storms on society.

Models are a way scientists represent the phenomena they are interested in. Find out more about using scientific models in teaching at:

'Teaching with models', Carleton College, *http://serc.carleton.edu/introgeo/models/index.html* **(Years F–12)**

'Teaching with models', New Zealand Ministry of Education, *http://scienceonline.tki.org.nz/Teaching-science/Teaching-Strategies/Teaching*-with-models **(Years F–12)**

'The very, very simple climate model', Spark, UCEAR Science Education *www.windows2universe.org/earth/climate/cli_model.html* **(Years 10–12)**

73. Dr Jane Hodgkinson

Dr Jane Hodgkinson is a geologist who is currently researching how the shift to renewable energy sources is impacting on the climate and how the mining industry is adapting to the changes. She is also investigating ways to store carbon dioxide underground (geosequestration). Dr Hodgkinson has also investigated periodic algae blooms in Brisbane City council's tunnelling programs and in the groundwater on Moreton Bay coastal islands.

For information about carbon capture and storage visit:

'Carbon capture and storage fact sheet', Oresome Resources, *www.oresomeresources.com/resources_view/resource/fact_sheet_carbon_capture_and_storage/section/resources/parent/category* **(Years 6–10)**

'Introduction to carbon capture and storage', Global CCS Institute, *www.globalccsinstitute.com/publications/introduction-carbon-capture-and-storage* **(Years 6–10)**

'Carbon capture and underground storage', US EPA, *http://www.epa.gov/climatestudents/solutions/technologies/ccs.html* **(Years 6–10)**

74. Dr Karen Kozielski

Dr. Karen Kozielski is a physical and materials scientist who leads a team of scientists and engineers at the CSIRO investigating new materials for use in pipelines carrying crude oil and gas from oil rigs in the oceans off the coast of Australia. This team is researching ways to maximise extraction of oil and gas while reducing their environmental impact, especially in the case of leaks and spills from the piping.

'Materials and their properties', Teaching Ideas, *www.teachingideas.co.uk/science/contents_materials.htm* **(Years 4–8)**

'Science: Materials and their properties', Primary resources, *www.primaryresources.co.uk/science/science3a.htm* **(Years 4–8)**

'Materials – solids, liquids and gases', Woodlands Junior School, *http://resources.woodlands-junior.kent.sch.uk/revision/science/changingmaterials.htm* **(Years 4–8)**

75. Dr Allan Hahn

Dr Allan Hahn (1951 –) is a sports scientist who pioneered the systematic identification and nurturing of sporting talent in Australia. Dr Hahn investigated the effect of altitude training on athletic performance, and research the impact of hot, humid conditions on athlete performance and health. This research resulted in the use of cooling vests at the Atlanta Olympic games by Australian athletes. Dr Hahn has pioneered the use of miniaturised digital monitors to monitor performance and health of athletes during events and training.

'Teaching resource units', Healthy Active Classroom', *www.healthy-active-classroom.com.au/Teaching-Resource-Units* are classroom resources specific to each state curriculum developed by the Australian Institute of Sport. **(Years F–10)**

The Australian Institute of Sport website *www.ausport.gov.au/ais/australias_winning_edge* has a large number of resources such as fact sheets and videos on a range of sports-related topics such as nutrition, sports science and sports medicine. **(Years F–12)**

76. Dr Steve Wilkins

Dr Steve Wilkins (1946–2013) was a physicist and mathematician who investigated x-ray scattering and solid-state physics. He was an enthusiastic pioneer in the construction and use of particle accelerators called synchrotrons for medical and industrial applications. Among many other contributions, Dr Wilkins' research led to improvements in x-ray techniques to give detailed images of soft tissues.

Information about the Australian Synchrotron can be found at Australian Synchrotron website *www.synchrotron.org.au* **(Years 9–10)**

The Australian Nuclear Science and Technology Organisation (ANSTO) has teacher resources, videos and fact sheets available at *www.ansto.gov.au/Resources/DiscoveryCentre/index.htm* **(Years 9–12)**

77. Dr Robert Gilbert

Dr Robert Gilbert (1946 –) is a polymer chemist who investigates the use of emulsions in polymerisation processes. Polymers are large molecules, such as plastics, that contain structural units that are joined in a repeated pattern. Dr Gilbert has developed processes to study the formation of polymers and has applied this determine the mechanisms of complex polymerisation reactions.

Create a range of different types of slime. See: 'Best of slime', CSIRO Education, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science//Chemical-sciences-activities/best-of-slime.aspx* **(Years 4–10)**

Explore the shrinking properties of some plastics. See 'Shrinkie shapes' – *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science//Chemical-sciences-activities/shrinkies-activity.aspx* **(Years 6–10)**

78. Stephen Newman

Stephen Newman (1956 –) is an optical research scientist who developed multifocal contact lenses. These lenses allow the wearer to focus at different distances using the same lens.

'Build your own 3D glasses', Stereo, NASA, *http://stereo.gsfc.nasa.gov/classroom/glasses.shtml* **(Years 4–12)**

Make your own jelly lenses: 'Jelly optics', CSIRO Education, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Physical-sciences-activities/jelly-lens-activity.aspx* **(Years 4–12)**

For some interactive simulations see:

'Bending light', University of Colorado, *http://phet.colorado.edu/en/simulation/bending-light* **(Years 5–11)**

'Colour vision', University of Colorado, *http://phet.colorado.edu/en/simulation/color-vision* **(Years 5–11)**

79. Professor Fiona Wood

Professor Fiona Wood (1958 –) is a plastic surgeon and medical researcher interested in burn injuries. She pioneered the development spray on skin

to treat burns victims. The technique developed by Professor Wood and her team grows skin cells from the victim over five days and then sprays them directly onto the burn.

Try the Yummy banana face-mask in 'Cosmetic chemistry', Science by email, CSIRO Education, *www.csiro.au/helix/sciencemail/activities/Soap.html* **(Years F–10)**

'Touch experiments', Neuroscience for kids, *http://faculty.washington.edu/chudler/chtouch.html* **(Years F–8)**

'Skin structure and function', ABPI Resources for schools, *www.abpischools.org.uk/page/modules/skin/index.cfm* **(Years 8–10)**

80. Jim Frazier

Jim Frazier (1940 –) is an inventor and naturalist whose interest in photography led him to develop a lens system which revolutionised the film industry. Mr Frazier's lens provides an extended depth of field and allows the foreground and background to be in focus at the same time. Mr Frazier has also won many awards for his photography and films about the natural world.

A photographic scavenger hunt is a fun way for students to learn about the natural environment. Give your students a list of photos to collect, for example, insects and plant types. Ask them to collect images using a digital camera or mobile phone camera.

'Geometric optics', University of Colorado, *http://phet.colorado.edu/en/simulation/geometric*-optics **(Years 10–12)**

81. Professor Ray Cas

Professor Ray Cas (1953 –) is a geologist whose research interests include volcanology, sedimentology and tectonics. He is an expert on the eruptions, hazards and natural resources produced by volcanic eruptions. Professor Cas uses his knowledge to help mining companies understand the links between volcanic activity and mineral deposits.

'Volcano experiment', Kidspot Australia, *www.kidspot.com.au/kids-activities-and-games/Science-experiments+10/Volcano-experiment+10984.htm* **(Years F–8)**

'How to make an underwater volcano for kids', eHow, *www.ehow.com/how_8609444_make-underwater-volcano-kids.html* **(Years F–8)**

'Teaching resources for Stages 4 & 5 – Natural disasters', University of Sydney, *http://sydney.edu.au/science/uniserve_science/school/resource/natdis.html#Volcanoes* **(Years F–10)**

82. Dr John O'Sullivan

Dr John O'Sullivan is an electrical engineer whose work in radio astronomy has led to the development of the technology which is responsible for wireless LAN becoming accessibly. In a nutshell he is one of the developers of the Wi-Fi that many of us use to access the internet. Dr O'Sullivan has also contributed to our understanding of black holes and adaptive optics.

To find out more about Wi-Fi and Dr O'Sullivan see:

'WiFi Windfall', Catalyst ABC, *www.abc.net.au/catalyst/stories/2708730.htm* **(Years 9–12)**

'Black hole science key to WiFi', ABC Science, *www.abc.net.au/science/articles/2012/09/18/3590519.htm#.Uc-13hacB5g* **(Years 9–12)**

'Wireless LANs', CSIRO, *www.csiro.au/en/Outcomes/ICT-and-Services/People-and-businesses/wireless-LANs.aspx* **(Years 9–12)**

83. Dr Colin Nexhip

Dr Colin Nexhip (1969 –) is a chemical engineer who investigates the processes that occur in molten metals during smelting. He designed processes to investigate this using a laser interferometer. By understanding how the minerals form metal oxide foam bubbles, Dr Nexhip has been able to increase reaction rates leading to a decrease in the greenhouse gases released by the smelting of iron ores.

Explore foam bubbles in these activities:

'Bubble sock experiment', SCOPE, *http://ten.com.au/images/Bubble_Sock_Experiment_Write_Up.pdf* **(Years 6–10)**

'Try this: Bubbles!', Science by email, CSIRO, *www.csiro.au/helix/sciencemail/activities/bubbles.html* **(Years F–10)**

'Producing a Foam', Learn Chemistry, Royal Society of Chemistry, *www.rsc.org/learn-chemistry/resource/res00000477/producing*-a-foam **(Years 6–10)**

84. Professor Martin Banwell

Professor Martin Banwell (1954 –) is an organic chemist who specialises in the synthesis of natural products based on extracts from organisms found on the Great Barrier Reef. One focus of Professor Banwell's research has been the synthesis of compounds found in sponges that potentially may treat lung cancer. Professor Banwell also investigates the use of enzymes to prepare organic molecules for use as building blocks for more complex molecules.

Explore these activities and websites about enzymes:

'Liver fizz', Helix@CSIRO, *http://csirohelixblog.com/2012/09/21/liver*-fizz (**Years 6–12)**

'How do enzymes work?', Science by email, CSIRO Education, *www.csiro.au/helix/sciencemail/activities/enzymes.html* **(Years 9–12)**

'What do the enzymes inside a cell do?', Discovery Kids *http://kids.discovery.com/home/what-do-the-enzymes-inside-a-cell-do* **(Years 9–12)**

'Enzymes make the world go 'round', Chem4kids, *www.chem4kids.com/files/bio_enzymes.html* **(Years 9–12)**

85. Professor Suzanne Cory

Professor Suzanne Cory is a biochemist and molecular oncologist interested in genetics and the immune system. She pioneered the use of gene cloning technology in Australia leading to the discovery of the genetic mutation that causes Burkett's Lymphoma. Professor Cory is currently researching a family of genes that influence whether cells live or die. She is also the current President of the Australian Academy of Science (2010–2014).

Resources for teaching senior students about the link between the immune system and cancer can be found at:

'The immune system', National Cancer Institute, *www.cancer.gov/cancertopics/understandingcancer/immunesystem* **(Years 8–12)**

'Cancer and the immune system', Cancer Research Institute, *www.cancerresearch.org/cancer-immunotherapy/resources/cancer*-and-the-immune-system **(Years 8–12)**

For interesting videos about the immune system see:

'How your body destroys invaders', ABC Splash (0:45 min) *http://splash.abc.net.au/media?id=31050* **(Years 8–12**)

'Immune system – Human organ systems for kids', YouTube (5:07 min) *www.youtube.com/watch?v=6uwVhn-APsQ* **(Years 8–12)**

86. Dr Mark Shackleton

Dr Mark Shackleton is a medical oncologist interested in how and why melanomas form and how they grow. He found that most cancerous cells can reproduce and form more cancerous cells, and that cancerous cells can evolve and so become resistant to treatment. Dr Shackleton and his team have developed a drug that tricks cancer cells into committing suicide. This drug does not affect healthy cells, reducing side effects to patients being treated. Dr Shackleton and his team are trialling the drug currently and are hopeful of it becoming a successful treatment for leukaemia and lymphoma. He won the 2012 Science Minister's Prize for Life Scientist of the Year.

While Dr Shackleton is developing cures for skin cancer and other cancers, preventing them is something we can all work towards. For resources to encourage Sun Safety in students try these websites.

'Schools and Early Childhood', SunSmart, *www.sunsmart.com.au/childcare_and_schools* **(Years F–12)**

'Curriculum resources for primary schools', Cancer Council NSW, *www.cancercouncil.com.au/24938/reduce-risks/sun-protection/sunsmart-program-for-primary-schools-and-ohsc/sunsmart-resources/primary-school-curriculum-resources.?pp=24938* **(Years F–7)**

'Real Stories: secondary school resource', Cancer Council Australia, *www.cancer.org.au/preventing-cancer/sun-protection/sunsmart-schools/real-stories-secondary-school-resource.html* **(Years 7–12)**

'Resources: Teachers and Schools', National Council on Skin Cancer Prevention: *www.skincancerprevention.org/resources/teachers-and-schools* **(Years F–12)**

87. Dr Peter Coppin

Dr Peter Coppin pioneered wind energy research through his investigation of boundary-layer meteorology. He leads research teams at the CSIRO that are developing wind turbines to maximise the amount of electricity generated from any available wind. Part of their work involves testing different designs using a boundary layer wind tunnel at Pye Laboratories in Canberra. Here they also develop computer models that and predict how turbines will function under different wind conditions.

'Build a model wind turbine', Science by email, CSIRO Education *www.csiro.au/helix/sciencemail/activities/windturbine.html* **(Years 4–12**)

'Wind-loving balloons', ExperiMENTALS, ABC, *www.abc.net.au/science/experimentals/experiments/episode14_4.htm* **(Years F–12)**

'Wind energy activities', STEMworks, *www.stem-works.com/subjects/2-wind-energy/activities* **(Years 4–12)**

88. Dr Victoria Haritos

Dr. Victoria Haritos is a chemist and toxicologist who studies the biochemistry of insects and other organisms. Dr Haritos and her team developed a fast-acting fumigant to protect harvested grains from pest insects. Dr Haritos is currently investigating the genes that govern the action of proteins that metabolise lipids. The goal of this research is to increase the efficiency of generating biofuels from plant materials such as straw and wood.

'Practical biofuel activities', Biotechnology and Biological Sciences Research Council, *http://bbsrc.ac.uk/society/schools/practical-biofuel-activities.aspx* (Years 8–12)

'Make biodiesel – Instructions for making biodiesel from vegetable oil', *About.com* Chemistry, *http://chemistry.about.com/od/chemistryhowtoguide/a/makebiodiesel.htm* **(Years 8–12)**

'Biofuels: 'Grow' your own fuel', Toshiba USA, *www.toshiba.com/taf/common/docs/Biofuels.pdf* **(Years 8–12)**

89. Professor Alan Trounson

Professor Alan Trounson (1946 –) is a stem cell biologist and in-vitro fertilisation pioneer who introduced the use of a fertility drug to induce multiple ova and the freezing of embryos for future use to increase the chance of a successful pregnancy. In 2000, Professor Trounson led the team that discovered that nerve stem cells could be derived from embryonic stem cells. The potential of stem cells to possibly cure a range of currently incurable diseases is one of the reasons for the interest in stem cell research worldwide.

Stem cell research is a great opportunity to explore the ethics of a scientific topic with older students. For information to stimulate the debate in your class try these links:

'About stem cells', National Stem Cell Foundation of Australia, *www.stemcellfoundation.net.au/about-stem-cells* **(Year 10)**

'RiAus PDplus: Synthetic biology – Creating life in the lab', RiAus *http://riaus.org.au/events/riaus-pd-synthetic-biology* is a unit exploring synthetic biology. It is supported by worksheets, animations and examples of genetic manipulation. **(Year 10)**

90. Dr John Williams

Dr John Williams is a water scientist who studied the Great Artesian Basin and the transport of water from the Great Dividing Range to outback Queensland and New South Wales. Dr Williams is interested in salinity and water catchment management, and their impact on land use and natural ecosystems. Deeply concerned about the use of Australia's water resources, Dr Williams is a member of the Wentworth Group of Concerned Scientists that aim to generate rational national debate on the subject.

Salinity is a major concern for land users in many regions of Australia.

'Backyard biodiversity salinity experiment', CSIRO Education, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Backyard-Biodiversity/Backyard-Biodiversity-salinity-experiment.aspx* **(Years 4–10)**

'Fresh and salty', Wimmera Catchment Management Authority, *www.wcma.vic.gov.au/index.php?option=com_content&task=view&id=102* **(Years F–7)**

'Backyard biodiversity salinity experiment',

'The Saltwatch Resource Book – part a: what is salinity?', Qld DERM, *www.nrm.qld.gov.au/services_resources/item_details.php?item_id=206595* **(Years 4–10)**

'The Saltwatch Resource Book – part b: Saltwatch for schools?', Qld DERM, *www.nrm.qld.gov.au/services_resources/item_details.php?item_id=206596* **(Years 4–10)**

'Effects of soil salinisation', Qld DERM, *www.nrm.qld.gov.au/education/teachers/land/activities/activity03.html* **(Years 4–10)**

'Salinity - our silent disaster', ABC, *www.abc.net.au/science/slab/salinity* (**Years 8–10)**

91. Dr Madhu Bhaskaran

Dr Madhu Bhaskaran is an electrical and computer engineer who is investigating ways to turn kinetic energy into

electrical energy. She leads a team assessing the capability of extremely thin piezoelectric materials that can be used to harvest the energy used when doing routine tasks such as walking. This can then be converted into electricity to run small appliances such as mobile phones and pacemakers.

Rochelle crystals have piezoelectric properties. To make Rochelle crystals follow the recipe at 'Rochelle Salt', Instructables, *www.instructables.com/id/Rochelle-Salt* **(Years 4–10)**

92. Dr Chris Prideaux

Dr Chris Prideaux specialises in microbiology and vaccine development. He developed a vaccine for respiratory diseases in cattle. Dr Prideaux has contributed to the development of vaccines for diseases in pigs and chickens. Currently he is working on a vaccine for amoebic gill disease in Tasmanian salmon – a condition that slows fish growth by attacking their gills.

For lesson plans about vaccines visit:

'Common Vaccinations', Discovery Education *www.discoveryeducation.com/teachers/free-lesson-plans/common-vaccinations.cfm* **(Years 7–10)**

93. Dr Thilak Gunatillake

Dr Thilak Gunatillake is a materials science and physical chemist whose research has focused on the development of synthetic polymers for medical applications. He has developed materials for use in medical implants and designed more efficient drug delivery systems. Dr Guantillake has developed a polymer gel called 'NovoSorb Biodegradable Polymer' that can be used to hold damaged joints together while they heal.

'The skeleton, bones and joints activity', BBC GCSE Bitesize, *www.bbc.co.uk/schools/gcsebitesize/pe/appliedanatomy/skeleton/2_anatomy_skeleton_act.shtml* **(Years 4–10)**

'Skeletons and muscles', Science Zone, *http://resources.woodlands-junior.kent.sch.uk/revision/science/living/humanbody.html* contains a collection of interactive games and resources. **(Years 3–10)**

94. Dr Bill Humphreys

Dr Bill Humphreys is a biologist who has investigated subterranean fauna. He has written several books about the curious organisms he has discovered. Dr Humphreys has investigated the importance of these organisms in keeping groundwater safe for human use as well as demonstrating how they share ancestors with similar organisms worldwide.

View some unusual groundwater organisms at the Subterranean Biology Collection of the Western Australian Museum *http://museum.wa.gov.au/research/collections/terrestrial-zoology/subterranean-biology-collection* **(Years F–12)**

View a transcript of an interview with Dr Humphreys: 'Underground diversity', The Science Show, ABC, *www.abc.net.au/radionational/programs/scienceshow/underground-diversity/3467470* **(Years 7–12)**

95. Professor Michael Sherburn

Professor Michael Sherburn is a synthetic chemist who is investigating methods for efficiently making compounds. He has pioneered the

development of Superbowl container molecules. These specially engineered molecules have the potential to serve a variety of uses including the delivery and release of medicinal drugs held inside the body at pre-determined times, the purification of reaction products and the removal of toxic compounds from the environment.

Try making models of some molecules that can be used to contain other molecules or atoms.

'Build a Buckyball', SEED, *www.planetseed.com/laboratory/ build-buckyball*
(Years 10–12)

Construction of the C60 Fullerene Model *http://cd1.edb.hkedcity.net/cd/science/chemistry/s67chem/pdf/sps_2_c60.pdf*
(Years 10–12)

96. Dr Abigail Allwood

Dr Abigail Allwood is a field geologist who is interested in the development of life on Earth. By investigating rock formations formed from the remains of ancient microorganisms called stromatolites she has to determined the age of life on Earth as at least 3.43 billion years. Dr Allwood currently works at NASA in the Planetary Chemistry and Astrobiology Division of the Jet Propulsion Laboratory.

'Australian Dinosaur Story – Create your own geological time line', Dept. of Environment and Heritage, *www.environment.gov.au/heritage/places/national/dinosaur-stampede/lark-quarry/pubs/studentactivities2-geologicaltimeline.pdf*
(Years 5–10)

Find out more about Australia over the last 600 million years at: 'Victoria evolves', Melbourne Museum, *http://museumvictoria.com.au/melbournemuseum/discoverycentre/600-million-years*
(Years 5–10)

'Australia Through Time poster- Geological Time Scale', Geoscience Australia, *www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=71079* is a set of free downloadable charts.
(Years 5–10)

Stromatalites growing in Hamelin Pool Marine Reserve, Shark Bat WA, Paul Harrison, *CC BY-SA-30*

97. Dr Estelle Giraud

Dr Estelle Giraud is a plant biologist investigating plant growth and response to stress at the cellular level. Dr Giraud's research has focused on understanding the way mitochondria function to provide plant cells with energy.

Find out about cells:

'The incredible edible cell', Queensland University of Technology, *http://cms.qut.edu.au/__data/assets/pdf_file/0019/23806/incredible_edible_cell_teacher_worksheet.pdf* **(Years 7–12)**

'The Great Cell WebQuest', Mr Hill's science website, *http://mrscienceut.net/CellWebquest.htm* **(Years 7–12)**

'How big is a …?', Cells alive!, *www.cellsalive.com/howbig.htm* **(Years 7–12)**

'Cells', Amazing Science Online!, *www.amazingscienceonline.com/cells*
(Years 7–12)

98. Professor Barry Brook

Professor Barry Brook (1974 –) is an environmental scientist who specialises in the development of ecological systems models. He has developed models of the extinction of species due to man-made catastrophes such as deforestation. Professor Brook is a passionate advocate of informed debate about the consequences and benefits of low-carbon energy mixes including nuclear energy and is developing models to explore these scenarios.

Encouraging biodiversity is one way to prevent the extinction of organisms. Explore your local biodiversity using these resources:

'Backyard Biodiversity', CSIRO Education, *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Backyard-Biodiversity.aspx* **(Years 2–10)**

'Biodiversity', Australian Museum, *http://australianmuseum.net.au/Biodiversity* **(Years 4–10)**

99. Professor Jane Visvader and Professor Geoff Lindeman

Professor Jane Visvader is a molecular biologist and medical researcher who is investigating the changes in breast tissue that lead to breast cancer. Her early work involved determining the role of stem cells in blood cancers. Professor Geoff Lindeman is a medical oncologist who has investigated the link between genes and breast cancer. Professor Lindeman and Professor Visvader lead a team studying the possible role of stem cells in the breast cancer with the aim of applying their understandings to the development of treatment for breast cancer.

Try this game illustrating how cancer cells multiply: 'Bust a cell', Cancer Research UK, *www.cancerresearchuk.org/cancer-info/youthandschools/gamesandpuzzles/busta-cell* **(Years 9–12)**

Here are some interactive animations that demonstrate the growth and treatment of different cancers: 'Cancer animations', BioAlive *www.bio-alive.com/animations/cancer.htm* **(Years 10–12)**

100. Professor Andrew White

Professor Andrew White specialises in quantum optics and quantum information science. He is investigating the use of light to encode and store information that has the potential to lead to super fast computers.

Interactive resources for teaching Light and Shadows can be found at: 'Light and Shadows', Woodlands Junior School, *http://resources.woodlands-junior.kent.sch.uk/revision/science/lightshadows.html* **(Years 5–7)**

Try these optical illusions: 'Best of illusions', CSIRO Education, *http://www.csiro.au/Portals/Education/Programs/Do-it-yourself-science/Biological-sciences-activities/best-of-illusions.aspx* **(Years 5–7)**

SCIENTIFIC INSTITUTIONS

SCIENTIFIC INSTITUTIONS IN AUSTRALIA

There are many highly-respected scientific institutions in Australia – some national and some state and territory based. Discover just a few of these institutions showcased below.

Australian Academy of Science

www.science.org.au/academy

Founded in 1954, the aim of the Australian Academy of Science is to promote science and excellence in science and do this through a range of activities from recognition of outstanding contributions to science, education and public awareness, science policy and international relations.

The Academy is host to the Fellowship of the Australian Academy of Science which is made up of 450 of Australia's top scientists. This has meant that the Academy has taken a leading role in international programs to improve Australian access to global science and technologies, collaborate on international research programs, exchange ideas and gain information and knowledge to advance Australian scientific endeavour.

The Academy has a strong focus on excellence in science education and publishing and currently produces an on-line educational website – *Nova: Science in the News*, newsletters, reports and in conjunction with the CSIRO, publish the Australian Journals of Scientific Research. Additionally, the Academy produces innovative educational materials for the teaching of science in schools, such as PrimaryConnections, and Science by Doing for secondary students. All of these programs provide engaging lessons and supporting documents for educators.

The Shine Dome at night. Australian Academy of Science © AAS

The Australian Academy of Science also supports and encourages innovation in science through the recognition and awarding of a series of medals, lectures and prizes to early-career and career scientists across all fields of science.

Reference: Australian Academy of Science website www.science.org.au/academy

Interviews with Australian Scientists

The Academy has interviewed some of Australia's greatest scientists for the Interviews with Australian scientists program. Scientists talk about their research and scientific achievements, as well as their early life, role models and how they became interested in science.

Videos of the interviews can be purchased from the Academy, and the transcripts and teachers notes are available online.

www.science.org.au/scientists/index.html

CSIRO – Commonwealth Scientific and Industrial Research Organisation

www.csiro.au

CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is Australia's national science agency and one of the largest and most diverse research agencies in the world.

Areas of interest that CSIRO focus on include:

- Issues that have impact for Australian as a nation
- Resources and education for teachers and students
- Breakthroughs in science
- Organisations that are partnering with CSIRO
- Research facilities and capabilities
- Informing on career opportunities

The CSIRO conducts research and provides information on such topics as:

- Climate change
- Energy
- Environment
- Food and agriculture
- Health and well-being
- ICT and services
- Manufacturing and materials
- Mineral resources
- Oceans and coasts
- Safeguarding Australia
- Understanding the Universe
- Water

Reference: CSIRO website www.csiro.au

CSIRO Energy Centre, Newcastle © CSIRO

Access the CSIRO website: *www.csiro.au* to find out information on a myriad of topics available for teachers and students of all ages. The diversity of topics and information that the CSIRO makes available is so large that it almost impossible to list them all!

Do you want to engage your science class in fun activities, projects or clubs? Try:

- Science by email: *www.csiro.au/Portals/Education/Kids/Read-it/Science-By-Email.aspx*
- Double Helix club and magazines: *www.csiro.au/en/Portals/Education/Programs/Double-Helix-Science-Club.aspx*
- Scientriffic: *www.csiro.au/en/Portals/Education/Programs/Double-Helix-Science-Club/ScientrifficMain.aspx*

Do you want to engage your students in real-time science conversation and communication? Try:

- Twitter: @CSIROnews OR @CSIROhelix
- Facebook: CSIRO – 26, 623 Likes and counting!

Questacon – The National Science and Technology Centre

www.questacon.edu.au

'The smarter way to have fun.'

'Questacon is the National Science and Technology Centre in Canberra that promotes greater understanding and awareness of science and technology in the community.'

Questacon balloon on top of Questacon, Flickr, laRuth, CC BY 2.0

The centre aims to engage children, teenagers and adults in scientific thinking with activities that are fun and interactive. This includes the very Spectacular Science Show! Must be seen to be believed!

Questacon not only provides these educational services, they also work with a variety of community and corporate partners to deliver science experiences to Australians in even the remotest part of the country. They have successful outreach programs including the Questacon Science Circus and Science Lines, an Indigenous Outreach program; and also conduct travelling exhibitions such as Imagination Factory (simple machines) and Perception Deception (perception tests and illusions!) to name a few.

Reference: Questacon website: www.questacon.edu.au

Questacon resources for schools

Investigate how your school can participate in one of Questacon's Travelling Exhibitions by accessing their website: www.questacon.edu.au/outreach/travelling-exhibtions

Looking for an excursion destination? Many school students visit Questacon every year – even from interstate! Investigate how your school could access one of Australia's best science action destinations!

Questacon is on Twitter @Questacon and Facebook! Join the conversation today.

Royal Institution of Australia (RiAus)

http://riaus.org.au

The Royal Institution of Australia is a virtual space where people can come together to listen, talk and think about science.

'RiAus brings science to people and people to science. It creates real and virtual spaces in which people can listen, talk and think about science in all its shapes and forms, and develop innovative and accessible ways of engaging the general community. It sets out to raise scientific awareness and the level of debate on critical issues around science and technology. RiAus strives to highlight the importance of science in everyday life.'

RiAus is situated in the old Adelaide Stock Exchange building ©RiAus/Ben Searcy

Watch videos about current scientific thinking and research projects; read current information about climate change or mobile phone addiction and access information on inspiring science in the classroom – just to name a few! Features include PD*plus*

classroom resources for teachers covering topics from wind farms to synthetic biology; Science behind the headlines, covering the latest science in the news, and keep up to date with what's happening with 'A week in science' vodcast.

Foundation partners for the institute are the Australian Government, Santos and the Government of South Australia. The patron is the HRH The Duke of Kent KG GCMG GCVO ADC, and the RiAus sister organisation is the Royal Institution of Great Britain.

Reference: Royal Institution of Australia http://riaus.org.au

Visit RiAus at *http://riaus.org.au* to find out more information and to access resources.

Australian National University Research School of Astronomy and Astrophysics (RSAA) and the Mt. Stromlo Observatory

http://rsaa.anu.edu.au

The ANU's Research School Astronomy and Astrophysics (RSAA) has a long and well renowned history of research and technical activity in the fields of astronomy and astrophysics (the study of the physics of the universe); including areas such as cosmology and planetary science.

The school has a number of aims including the advancement of observational and theoretical frontiers of astronomy and astrophysics and providing national and international scientific leadership. The school is recognised for their training of outstanding scientists.

The RSAA has also played host to outstanding scientists such as Professor Brian Schmidt (Nobel Prize winner for Physics 2011), Professor Ken Freedman and Professor Lawrence Krauss.

The RSAA carries out four main areas of research including:

- Galactic archaeology– the study of the content, dynamics and evolution of galaxies.
- Cosmology– the study of the contents and evolution of the Universe as a whole.
- Planetary science – the study of the formation and evolution of planets, both in the Solar System but especially around other stars.
- Black hole phenomena – the discovery of the locations of black holes and the study of their interactions with their environments.

The RSAA's future projects include the participation in a billion-dollar international Giant Magellan Telescope. This telescope has 100 times the sensitivity of the Hubble Space Telescope which is capable of delivering ten times sharper images of space!

The RSAA is located at Mt. Stromlo Observatory (MSO) in Canberra and also operates Sliding Spring Observatory at Coonabarabran in New South Wales. The Mt. Stromlo Observatory is home to the RSAA facilities and mechanical, electronic and optical workshops. Sliding Spring Observatory (SSO) is Australia's premier facility for optical and infrared astrophysics observations.

Reference: RSAA website http://rsaa.anu.edu.au

74" refractor telescope at Mt Stromlo Observatory, Flickr, ibsut, *CC BY 2.0*

Australian Academy of Technological Sciences and Engineering (ATSE)

www.atse.org.au

The ATSE works with some of Australia's leaders in the fields of technology and engineering with the aim of applying technology in smart, strategic ways. The ATSE fosters research in technological sciences and engineering, manages the development and implementation of educational programs and works closely

with international communities to address important national issues surrounding technological and engineering advances.

The ATSE aims to promote the development and adoption of innovative programs and technology in number of fields such as water, energy, health and education.

Reference: ATSE website www.atse.org.au

Read more about ATSE and their research, programs and awards at their website.

Australian Antarctic Division (AAD)

www.antarctica.gov.au

The Australian Antarctic Division leads Australia's Antarctic program and is part of the Australian Government's Department of Sustainability, Environment, Water, Population and Communities. The AAD website has a wide range of information and resources related to the science and environmental management of one of the world's most fascinating and extreme environments.

Scientific research and the Australian Antarctic Territory (AAT) have been an enduring partnership since the first expeditions were led there in 1911 by Douglas Mawson. In 2011, Australia celebrated 100 years of scientific endeavour and Australian Antarctic expeditions that have been vital in the global understandings of Antarctica.

Scientific research conducted in Antarctica is varied and includes studies of geology, geography, cartography, geomagnetism, astronomy, meteorology, glaciology, oceanography, zoology, biology and botany. Data collection from past expeditions is still used today to compare with that which is collected in modern research.

The website contains information for people of all ages to gain an understanding of this extreme environment. Read about Antarctica and its wildlife, environment and history. View images of the landscape and wildlife, captured by the people who live and work there.

Access educational resources such as 'Classroom Antarctica' or take a guided tour of Davis station. The ABC's page 'Antarctic Summer' is dedicated to information and footage gathered during the 2011 marine science voyage and features information on a range of Antarctic conditions and animals.

Reference: Australian Antarctic Division website www.antarctica.gov.au

Activity (Years 6–10)

- Ever wondered what it would be like to live and work in Antarctica?

  Read information about the people (and not just scientists) that live and work in the AAT.

  Learn about the processes through which expeditioners have to go through in order to prepare for living and working in Antarctica.

  www.antarctica.gov.au/living-and-working

- Have YOU ever wanted to work or live in Antarctica?

  Access information, expeditioner profiles and vocational guidance tests to see if you would be suitable to work in Antarctica!

  www.classroom.antarctica.gov.au/living/careers-in-the-antarctic

PROFESSIONAL BODIES AND INSTITUTES

University of Queensland Diamantina Institute (UQDI)

www.di.uq.edu.au/index.html

The University of Queensland Diamantina Institute is a research facility based at the Princess Alexandra Hospital in Brisbane, QLD. The institute is host to over 200 researchers that focus on the research into cancer and disorders of immune regulation. The Institute lays claim to the global, world-changing discovery of the world's first cervical cancer vaccine. Professor Ian Frazer is the current CEO and Director of Research at UQDI.

Reference: UQDI website *www.di.uq.edu.au/index.html*

Activity (Years 6–10)

Learn about the work of Professor Ian Frazer. Use these websites to get started:

- *www.di.uq.edu.au/ifrazerprofile*
  Diamantina Institute website
- *http://science.org.au/scientists/interviews/f/if.html*
  Australian Academy of Science website
- *https://grants.innovation.gov.au/SciencePrize/Pages/Doc.aspx?name=previous_winners/PM2008Frazer.htm*
  Prime Minister's Prize for Science website

Walter and Eliza Hall Institute of Medical Research (WEHI)

www.wehi.edu.au

The Walter and Eliza Hall Institute of Medical Research is the oldest medical research institute in Australia. Based in Melbourne, Victoria the institute was established in 1915 with its focus being on the prevention and removal of disease and the mitigation of suffering.

The WEHI has a strong focus of research into such diseases as cancer, including breast, lung and bowel cancers; chronic inflammatory diseases such as coeliac disease and Type I Diabetes Mellitus and infectious diseases such as Malaria.

WEHI provide educational programs for schools, university students and graduates and have their own TV channel called WEHI.TV. WEHI.TV explains the discoveries of scientists through 3D animation. They present information using animation to illustrate ideas about science that are hard to visualise when described using words.

Reference: WEHI website *www.wehi.edu.au*

Activity (Years 6–10)

Access WEHI.TV through the website *www.wehi.edu.au/education/wehitv/* and view titles such as 'Breast Stem Cells', 'The Immune System', 'Malaria Lifecycle Part 1: Human Host' or 'Haemoglobin and Sickle Cell Anaemia' to name a few!

The Garvan Institute

www.garvan.org.au

> *'The Garvan Institute of Medical Research is a world leader in biomedical research, pioneering study into some of the most widespread diseases affecting our community today. Research at Garvan is focused on understanding the role of genes and molecular and cellular processes in health and disease as the basis for developing future cures. The Garvan Institute's ultimate goal is the prevention and cure of these major diseases.'*

The Garvan Institute has had significant breakthroughs in the understanding and treatments of a number of diseases including cancer, Alzheimer's and Parkinson's disease and osteoporosis.

Reference: The Garvan Institute website *www.garvan.org.au*

Australian Institute of Physics (AIP)

www.aip.org.au

The AIP promotes the role of physics in the areas of research, education, industry and the community and are currently celebrating their 50th anniversary.

One area the AIP focus on is the promotion and support of physics teaching and education in schools, colleges and universities in Australia. The AIP has a myriad of physics resources for teachers on a number of topics ranging from 'Physics in a nutshell' to 'Everything you wanted to know about nuclear power'. The AIP conducts student competitions such as the Sydney University School of Physics 'Build Something' competition; the University of Newcastle Science and Engineering Challenge and the YSA Science Challenge.

Reference: AIP website *www.aip.org.au*

AIP resource

The AIP is turning 50! Celebrate with the AIP my participating in a number of events and programs being held throughout 2013.

Access the AIP webpage for information on upcoming events. *www.aip.org.au/info/q=content/aip-turning-50*

Join in celebrating with the AIP – follow them on Twitter @ausphysics and Facebook!

Royal Australian Chemical Institute (RACI)

www.raci.org.au

The RACI is an organisation that aims to promote and advocate the importance of chemistry to the public and all levels of education, industry and government. RACI communicates the importance of chemistry to the public and assists educational institutions in identifying and meeting the needs of students and educators in chemical related education. They actively engage in the raising awareness of chemistry education in schools, and provide leading professional development of professionals through its membership program.

RACI publishes the 'Chemistry in Australia' magazine which contains a number of articles, information and news about chemists, industry and other matters of interest; along with other publications such as the TCE magazine and the PCCP Journal. They hold the annual National Chemistry Week and the Australian National Chemistry quiz each year, which involves the participation of over 140, 000 schools over fifteen countries.

Their website provides teaching resources for primary and secondary teachers and information on state Crystal Growing competitions. Visit the website for more details on how your school can participate in these programs *www.raci.org.au/education/educational-resources* and information on how to become a member.

Reference: RACI website www.raci.org.au

RACI resource

In 2011, RACI wrote the ASTA National Science Week resource book *React to Chemistry*. It is available as a downloadable PDF or as a digital book on the ASTA website *http://asta.edu.au/programs/natscienceweek/resources/resources2011* It is loaded with chemistry information and activities for students years F–10.

The Australian Institute of Biology

www.aibiol.org.au

The Australian Institute of Biology (aib) aims to represent and develop the biology profession in Australia and actively promotes the education and research of biology in Australia.

The Australian Institute of Geoscientists

www.aig.org.au

The AIG is the leading professional institute representing geoscientists in all professional sectors in Australia.

The Australian Institute for Bioengineering and Nano-technology – University of Queensland

www.aibn.uq.edu.au

The AIBN is a new research institute which focuses on research into areas that provide great benefit for human health, manufacturing, information technology and the environment.

THE NOBEL PRIZE

THE NOBEL PRIZE

What is a Nobel Prize?

The Nobel Prize is an international award that is bestowed upon those men and women who have made outstanding achievements in the fields of physics, chemistry, physiology or medicine, literature and peace. The first awards were conducted in 1901 and in 1968 the award for economic science was added. The Nobel Foundation in Stockholm, Sweden administers the awards. Each person is awarded a prize that consists of a medal, personal diploma, and a cash award.

Information adapted from the official web site of the Nobel Prize. *www.nobelprize.org/alfred_nobel/biographical/articles*

The man behind the Nobel Prize

Alfred Nobel was born in Stockholm, the capital of Sweden, in 1833 and died in San Remo, Italy in 1896. His father Immanuel Nobel was an engineer and inventor who built bridges and buildings in Stockholm. In connection with his construction work, Immanuel Nobel also experimented with different techniques for blasting rocks. Nobel's father formed a mechanical workshop and supplied the Russian army with naval mines and was also a pioneer in arms manufacture and designing steam engines.

Alfred Nobel was educated in Russia and his education included natural sciences, languages and literature. By the age of seventeen Alfred Nobel was fluent in several languages including Swedish, Russian and French. His interests were in English literature and poetry, as well as in chemistry and physics. Alfred Nobel also studied chemical engineering and worked with the chemist, Ascanio Sobrero who invented nitro-glycerine – a highly explosive liquid that was prone to explode in an unpredictable manner and was considered highly dangerous.

Nobel was extremely interested in nitro-glycerine and how it could be put to use in construction work. He was determined to develop a way to make nitro-glycerine more stable. After many failed attempts and explosions, including one that killed his brother and several other people, he was successful in developing a process to make nitro-glycerine more stable. He discovered that by mixing nitro-glycerine into a paste it could be shaped into rods, thus making it more stable under heat and pressure. He named this invention 'dynamite'.
He also invented the blasting cap that enabled dynamite to be detonated using a fuse – thus making its explosion more controlled. He patented this, along with 355 other inventions. The demand for

dynamite grew rapidly and as Nobel was a very successful businessman, he was soon exporting his dynamite and blasting caps all over the world. Over his lifetime, Nobel also started 87 businesses and factories with his main focus being on the development of explosives technology as well as others such as synthetic rubber, leather and artificial silk. Some of these businesses are still operating in some form today.

Throughout his life, Nobel was very interested in social and peace-related issues. He also had a great interest in literature and wrote his own poetry and dramatic works. The Nobel Prizes became an extension and a fulfilment of his lifetime interests.

According to his will, Alfred Nobel's enormous fortune was to be used to establish prizes to award those who had done their best to benefit mankind in the fields of physics, chemistry, medicine, literature and peace.

The first Nobel Prizes were awarded in 1901, five years after Nobel's death. In 1969, another prize was added 'The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel'.

Reference: Information courtesy of Ringertz, Nils. 'Alfred Nobel - His Life and Work'. Nobelprize.org. 3 Feb 2013 www.nobelprize.org/alfred_nobel/biographical/articles/life-work/index.html

Read more about Alfred Nobel's life or read his will at: www.nobelprize.org/alfred_nobel/biographical/timeline

Australian Nobel Laureates

Since 1915, fourteen Australians (either born in Australia or Australian citizens) have been awarded the prestigious Nobel Prize. Considering the population size of our country, this is quite an outstanding achievement!

All except one of these prizes has been in the field of science, with most being awarded for outstanding achievements in the field of Physiology and Medicine.

Australia's winners are listed below with a brief reference to why they won.

1915 – William Henry Bragg and William Lawrence Bragg – Nobel Prize for Physics

'…for their services in the analysis of crystal structure by means of X-rays'. William Lawrence Bragg was the youngest ever laureate, aged 25.

1945 – Howard Walter Florey – Nobel Prize for Physiology and Medicine

Shared the prize with his British colleagues Sir Alexander Fleming and Ernest Boris Chain 'for the discovery of penicillin and its curative effect in various infectious diseases'.

1960 – Frank Macfarlane Burnett – Nobel Prize for Physiology and Medicine

Shared the prize with British Professor Peter Brian Medawar 'for discovery of acquired immunological tolerance'.

1963 – John Carew Eccles – Nobel Prize for Physiology and Medicine

Shared the prize with British professors Alan Lloyd Hodgkin and Andrew Fielding Huxley 'for their discoveries concerning the ionic mechanisms involved in excitation and inhibition in the peripheral and central portions of the nerve cell membrane'.

1964 – Aleksandr Mikhailovich Prokhorov – Noble Prize for Physics

Shared the prize with American Professor Charles Hard Townes and Russian Dr Nicolay Gennadiyevich Basov 'for fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser principle'.

1970 – Bernard Katz – Nobel Prize for Physiology and Medicine

Shared the prize with Swiss Professor Ulf von Euler and American Dr Julius Axelrod, 'for their discoveries concerning the humoral transmitters in the nerve terminals and the mechanism for their storage, release and inactivation'.

1973 – Patrick White – Nobel Prize for Literature (non-science)

For his novel "Eye of the Storm'; '…an epic and psychological narrative art which has introduced a new continent into literature'.

1975 – John Warrup Cornforth – Nobel Prize for Chemistry

'…for his work on the stereochemistry of enzyme-catalyzed reactions. He shared the prize with Swiss Professor Vladimir Prelog, for his research into the stereo-chemistry of organic molecules and reac-tions. They did not work together, however they had commonality with their research.

1996 – Peter Charles Doherty – Nobel Prize for Physiology and Medicine

Shared the prize with Swiss Professor Rolf M Zinkernagel 'for the discovery of how the immune system recognises virus-infected cells'. (For a poster and further information see *http://science.org.au/nobel*

2005 – J Robin Warren and Barry James Marshall – Nobel Prize for Physiology and Medicine

'…for their discovery of the Helicobacter pylori bacterium which causes stomach peptic ulcers and gastritis'. (For a poster and further information see *http://science.org.au/nobel*

2009 – Elizabeth Helen Blackburn – Nobel Prize for Physiology and Medicine

Shared the prize with American scientists Carol W. Greider and Jack W. Szostak 'for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase'.

2011 Brian Schmidt – Nobel Prize in Physics

Shared the prize with two American researchers, Saul Perlmutter and Adam Riessfor 'for the discovery of the acceler-ating expansion of the Universe through observations of distant supernovae'.

References: http://australia.gov.au/about-australia/australian-story/australias-nobel-laureates, http://nowlearning.com.au/resources/australias-nobel-prize-winners-our-academic-pride-and-joy, http://science.org.au/nobel/

Activity (Years 6–10): Read more about Australia's Nobel Prize winners

Read in greater detail the achievements of Australia's Nobel Prize winners *http://australia.gov.au/about-australia/australian-story/australias-nobel-laureates*

Activity (Years 3–10): Persuasive letter to the Nobel Foundation

Conduct some research on an Australian scientist or doctor and write a persuasive argument to the Nobel Foundation about why you think that particular scientist or doctor should be awarded a Nobel Prize.

Some suggestions include:

- Professor Ian Frazer and Dr Jian Zhou – developers of the HPV and cervical cancer vaccine.
- Dr Fiona Wood and scientist Marie Stoner – developers of 'spray-on skin' which is a skin culturing treatment for burns victims.

AUSTRALIAN AMBASSADORS FOR SCIENCE

What is a Science Ambassador?

A science ambassador is a person who supports and activity promotes science to young people and the community and can be seen as a spokesperson or representative for science engagement.

Science Communicators

Dr. Karl Kruszelnicki AM

Dr. Karl Kruszelnicki AM could be considered one of the most high profile ambassadors for science in Australia today. Best known as Dr. Karl, he is a scientist, author and science commentator on Australian TV and radio. Dr. Karl has had a wide variety of career experiences and holds degrees in mathematics, biomedical engineering, medicine and surgery. Dr. Karl is the Julius Sumner Miller Fellow in the Science Foundation for Physics at the School of Physics, University of Sydney. In 2012, he was named a National Living Treasure, awarded by the National Trust of Australia (NSW).

Reference: Wikipedia: Dr. Karl Kruszelnicki http://en.wikipedia.org/wiki/Karl_Kruszelnicki

Dr. Karl's current work as a popular science journalist, author and broadcaster has him educating people across the nation and the globe about science and science related topics. Dr. Karl uses his humour and charisma in his books, TV programs and on his radio presentations to get across his ideas on science and scientific thinking. Dr. Karl encourages people to think critically about the world around them, to investigate claims and look for evidence when thinking and learning about a range of topics.

For more information on Dr Karl visit his website *www.drkarl.com/home* or Dr Karl on the ABC Science *www.abc.net.au/science/drkarl/*

Bernie Hobbs

Bernie Hobbs is a science broadcaster, communicator and media personality who is passionate about science and science education. The former high school science teacher and biomedical researcher has been writing and speaking about science since 1997. Through her websites and weekly radio shows, Bernie loves to talk about and get others talking about science, using humour and fun. Bernie has regular radio slots in Melbourne, Sydney and Brisbane and hosts science events across the country such as the Peter Doherty Awards in Queensland.

Bernie has used her humour to get kids interested in science – her websites aim to put the 'fun' back into the 'fundamentals' of science. Bernie also works closely with Ruben Meerman – the 'Surfing Scientist'

Activity (Years 5–10): Learn more about science with Bernie

Learn more about science with Bernie by visiting the following websites;

- Science basics with Bernie Hobbs *www.abc.net.au/science/basics*
- ExperiMENTALS website: Who are the experiMENTALS? *www.abc.net.au/science/experimentals*

Ruben Meerman – the Surfing Scientist

Ruben Meerman is a surfer with a physics degree – maybe that's why he's' known as the Surfing Scientist! Growing up in Bundaberg, Qld and studying in Brisbane and the Gold Coast, has given Ruben plenty of opportunities to follow his passions for surfing, marine science and science education! Like the other featured ambassadors, Ruben is passionate about educating kids about science. Ruben has a Bachelor of Applied Science, majoring in Physics and has studied and worked at Queensland University of Technology, the Australian National University and Griffith University. During his studies at Griffith University, Ruben realised there was a need for students and teachers to get engaged in science and won a grant to produce a celebrity whodunit competition for schools called "Who Stole the Mayor's New Malibu? The competition engaged students in solving the mystery using forensic science techniques – all within the classroom!

Ruben has also worked with Bernie Hobbs on ExperiMENTALS and been a guest speaker on radio and television shows such as Sleek Geeks, Roller Coaster and Catalyst. Ruben now spends his time travelling around the country inspiring students with his live science demonstrations and writing science education resources and books for teachers.

Visit the Ruben Meerman's website *www.surfingscientist.com* where you can watch videos of science experiments and download lesson plans to engage your students with science. Also find out how you can have Ruben visit your school.

Dr Robert Bell

Dr Robert Bell is the host of the TV Science Program SCOPE and is also a Science Education Officer for CSIRO Education in Brisbane. Dr Rob has a Bachelor of Science degree from the University of Queensland and is passionate about the environment and the human impact on its resources.

Dr Rob uses his 'mad-scientist' persona to bring fun to science education for kids through his television program SCOPE.

Activity (Years 3–10): SCOPE TV

Learn more about science by watching Dr Rob on SCOPE TV.
http://ten.com.au/scope.htm

THE CHIEF SCIENTIST FOR AUSTRALIA

What does the Chief Scientist for Australia do?

> "The Chief Scientist for Australia provides high-level independent advice to the Prime Minister and other Ministers on matters relating to science, technology and innovation".

Reference: Australian Government © Commonwealth of Australia www.chiefscientist.gov.au

The role of the Chief Scientist is to assist the government with accessing leading scientific professionals and networks on a national and international basis. In order to move Australia forward in addressing scientific challenges and opportunities, the Chief Scientist is instrumental in providing the government with the most up to date, independent and authoritative scientific advice today.

Who is the current Chief Scientist for Australia?

Professor Ian Chubb commenced the role of Chief Scientist 23 May 2011. A neuroscientist by training, he has had a long and distinguished career in higher education and research.

Activity (Years 5–10): The Chief Scientist for Australia

Visit the website: Australia's Chief Scientist *www.chiefscientist.gov.au*

Read more about the achievements and role of Professor Ian Chubb: *www.chiefscientist.gov.au/about/biography-2*

Learn about:

- upcoming events
- speeches and interviews with the Chief Scientist
- ongoing science and research

Activity (Years 5–10): Learn more about the Chief Scientists for these states of Australia:

- Queensland Chief Scientist – Dr Geoff Garret AO
  www.chiefscientist.qld.gov.au
- New South Wales Chief Scientist and Engineer – Professor Mary O'Kane:
  www.chiefscientist.nsw.gov.au
- Victoria Chief Scientist – Dr Graham Mitchell AO
  www.sciencevictoria.org.au/home.html
- South Australia Chief Scientist – Professor Don Bursill AM
  www.dfeest.sa.gov.au/science-research/chief-scientist-for-south-australia
- Western Australia Chief Scientist – Professor Lynn Beazley
  www.sciencewa.net.au/science-in-wa/chief-scientists-blog.html

SCIENCE AWARDS

RECOGNISING AUSTRALIA'S SCIENTIFIC ACHIEVEMENTS

Prime Minister's Prizes for Science

www.innovation.gov.au/Science/InspiringAustralia/PrimeMinistersPrizes-forScience/Pages/default.aspxPrime

The Prime Minister's Prizes for Science are the nation's most prestigious and highly regarded awards for excellence in science and science teaching. Five prizes are awarded annually to Australian citizens or permanent residents each year and these are the:

- Prime Minister's Prize for Science
- Science Minister's Prize for Life Scientist of the Year
- Malcolm McIntosh Prize for Physical Scientist of the Year
- Prime Minister's Prize for Excellence in Science Teaching in Primary Schools
- Prime Minister's Prize for Excellence in Science Teaching in Secondary Schools.

Scientists and science educators follow a nomination process and make submissions to inform a selection committee about their achievements and/or innovations in their appropriate field.

Australian Academy of Science Awards

http://science.org.au/awards/

The Australian Academy of Science awards outstanding contributions to the advancement of science. The honorific awards recognise distinguished career scientists and scientists for research and life-long achievements. Awards are open to any scientist in Australia.

The Australian Academy of Science also sponsors a teacher from each state and territory to attend its annual Science at the Shine Dome conference in Canberra. The conference activities include the New Fellows seminar, presentations, education workshop and annual symposium. Teachers who are selected are

Activity (Years 6–10)

2013 Honorific Award Recipients

- Read about the recipients of the 2013 Honorific Awards and their research at the Australian Academy of Science website. *http://science.org.au/awards/awardees/2013awards.html*

expected to present how they have successfully taught science in their own classrooms.

Australian Museum Eureka Prizes

http://eureka.australianmuseum.net.au/

The Australian Museum presents annual Eureka Prizes rewarding excellence in the fields of research and innovation, leadership and commercialisation, school science and science journalism and communication.

Prizes for 2013 will be awarded for excellence and achievements in Environmental Research, Innovative Use of Technology, Leadership in Science and Promoting Understanding of Australian Science Research to name a few. The Sleek Geeks Eureka Science School Prizes are open to primary and secondary school students.

Young Tall Poppy Science Awards

www.aips.net.au/tall-poppies/tall-poppy-campaign/young-tall-poppy-science-awards

The Young Tall Poppy Science awards are presented by the Australian Institute of Policy and Science and are a prestigious award presented to Australia's young scientific researchers and communicators for their outstanding achievements in their associated fields. The aim of the awards is to recognise scientific achievement and to encourage Australian students to follow in the scientific footsteps of others.

The award winners participate in education and community outreach programs in which they become role models to inspire school students and the broader community about the possibilities of science. These outreach programs include public talks and workshops, visits to schools and educational seminars.

The Tall Poppy awards and outreach program also take place in each state across Australia.

Activity (Years 6–10)

Read about the Tall Poppies in your state

- Read about the Tall Poppy campaign in your state including award winners and outreach programs.
- The home page of the website will direct you to access the appropriate page for your state. *www.aips.net.au/tall-poppies/tall-poppy-campaign*

2013 Science and Innovation Awards for Young People

www.daff.gov.au/abares/conferences-events/scienceawards

The Department of Agriculture, Fisheries and Forestry offers annual grants to young science students to undertake projects on an emerging scientific issue or innovative activity. The awards aim to encourage science, innovation and technology in the rural industry. The awards are also aimed at advancing the careers of young scientists and innovators by offering awards that allow them to further pursue their research. The awards recognise their research ideas on a national scale.

SCIENCE IN SCHOOLS

SCIENCE IN SCHOOLS: PROGRAMS, COMPETITIONS AND AWARDS

PROGRAMS

There are many programs, both national and state-based, that encourage the participation of students and teachers with science in schools. Here a just a few:

Scientists in Schools CSIRO

The Scientists in Schools program is a national initiative that creates and supports long-term partnerships between teachers in schools and local scientists. Teachers and scientists are partnered together and come to mutual arrangements to bring science activities into the classroom. Mathematicians in Schools is a similar program.

Learn more about the Scientists in Schools program

- Check out some of the showcases of the Scientists and Mathematicians in Schools program provided by the CSIRO. *www.scientistsinschools.edu.au*
- Register your class for the Scientists or Mathematicians in Schools program.

Classroom Antarctica

Classroom Antarctica is an online teaching program provided by the Australian Antarctic Division. It engages students with real-world applications in science, mathematical and environmental learning. Students and teachers are given the opportunity to explore a number of aspects of the Antarctic region including studying the climate and nature of Antarctica, exploring information about Antarctic heroes of the past and learning about the people who work and live in Antarctica. Students are also given the opportunity to learn about the stewardship of the region.

Learn more about Classroom Antarctica

- Access information and resources for the Classroom Antarctica online learning program. *http://classroom.antarctica.gov.au*

CarbonKids

CarbonKids is a program for primary and secondary schools run by CSIRO Education in partnership with Bayer. It involves schools in sustainability initiatives that benefit both the school and community and implements the latest climate change science to support the learning. Schools measure their greenhouse emissions, set targets to reduce both emissions from school and at home, plant trees and improve their environmental performance. Schools must formally register for the program to receive a set of integrated curriculum units, professional development to aid in the implementation of the program and additional resources.

Learn more about CarbonKids

To find out more about the Carbon Kids program, to find resources and to register for the program visit. *www.csiro.au/carbonkids*

National Science Teachers Summer School (NSTSS)

The NSTSS is held in Canberra in mid-January each year on the campus of the Australian National University. It is a partnership program between the National Youth Science Forum, the Australian Science Teachers Association, the Australian National University and the University of Canberra and is designed to provide teachers of science unique experiences in science and science education in order to stimulate their passion for science and, in turn, enhance their teaching of science to their students.

A competitive application process is held in September. Successful applicants (approx. 40) receive all travel, accommodation, meals and tuition costs free of charge. Teachers who are at least teaching science half-time in their school are eligible to apply.

Learn more about the NSTSS

For more information visit the National Youth Science Forum website *www.nysf.edu.au/other/teachers* or the ASTA website *http://asta.edu.au/programs/nstss*

COMPETITIONS AND AWARDS – NATIONAL

It is easy to search online for competitions and awards to enter and nominate for in your state. Search for ones that might match your achievements or that look interesting and worth a try.

BHP Billiton Awards – Student and Teacher Awards

www.scienceawards.org.au/default.asp

'The BHP Billiton Science and Engineering Awards are Australia's most prestigious school science awards.

The BHP Billiton Science and Engineering Awards reward young people who have undertaken practical research projects, which demonstrate innovative approaches and thorough scientific procedures.

The BHP Billiton Science Teacher Awards recognise outstanding contributions made by classroom teachers to science education. Each Science Teachers Association will be invited to nominate one teacher, chosen for their excellence in teaching, their support of open-ended student investigations and their suitability to represent their state or territory.'

Reference: BHP Billiton website © Commonwealth Scientific and Industrial Research Organisation, 2003-2013. www.scienceawards.org.au/default.asp

The BHP Billiton Science and Engineering Awards are open to all Australian citizens or permanent residents enrolled full-time in Australian primary or secondary schools (including home-schooled) or undertaking full-time secondary study in TAFE colleges. These include students from all year levels.

The 2013 winners range from primary and secondary schools from across Australia.

Activity (Years 6–10): Read about the winners of the 2013 BHP Billiton Awards

- Read about the winners and their investigations such as 'Child seat alert: an innovative thermal monitoring device' and 'A spoonge full of medicine is just what the doctor ordered'.
- Visit the website to find out information about how to participate in the BHP Billiton Awards. *www.scienceawards.org.au/default.asp*

Australian Science Olympiads

www.asi.edu.au/site/programs_aso.php

The Australian Science Olympiad Competition is a prestigious competition and selection process for the International Science Olympiads – the Olympic Games for science students.

Students sit a biology, chemistry or physics exam in order to be selected for a representative place at the Australian Science Olympiad Summer School where they are given the opportunity to study with other high performing senior science students. The best of the summer students are then chosen to be representatives for Australia in the international competition.

Rio Tinto Big Science Competition

The Rio Tinto Big Science Competition is an annual, one-hour exam of 30 multiple-choice questions sat at school. Schools register each student to participate and the test can be sat anytime between the nominated dates each year.

The paper is based on the Australian Curriculum – Science topics and is open to students across Australia in the categories of:

- Junior – years 7 and 8
- Intermediate – years 9 and 10
- Senior – years 11 and 12

Participate in the Rio Tinto Big Science Competition in 2014

Register your school for next year's competition at the Rio Tinto Big Science website: *www.asi.edu.au/site/programs_bigscience.php*

University of New South Wales International Competitions and Assessments for Schools (ICAS)

www.eaa.unsw.edu.au

The University of New South Wales each year conducts the International Competitions and Assessments for Schools. These are independent skills-based assessments with a competition element. The ICAS covers subjects such as writing, spelling, computer skills, English, mathematics and science.

There are over 1 million entries received by the University of NSW every year. Students receive certificates for their participation and achievements and students with the top score in each subject in each year level are awarded a medal and a medal winner's certificate.

This is a great way for students to participate in a competition where they can receive an award for their participation regardless of the standard of their achievements. Medal winners are also recognised at medal ceremonies around the country.

Practice for the University of NSW ICAS

- Learn about the ICAS Science Competition at the University of New South Wales website *www.eaa.unsw.edu.au*
- Practice online in your classroom – investigate how! *www.eaa.unsw.edu.au/practice-online*

CSIRO CREST Awards
(Creativity in Science and Technology)

www.csiro.au/crest

CSIRO CREST Awards program:

- is open to all primary and secondary students
- covers both science and technology areas of the curriculum
- is non-competitive
- encourages success and the development of skills and processes
- allows students to pursue a topic of interest to them
- is open-ended.

Reference: CSIRO © Commonwealth Scientific and Industrial Research Organisation, 2003-2013. www.csiro.au/crest

The CREST awards are aimed at engaging students in scientific research and to encourage participation in scientific and engineering careers into the future.

Sleek Geeks Eureka Science School Prize

www.abc.net.au/science/sleekgeeks/eureka

The Sleek Geek Eureka Science School Prizes are presented by the University of Sydney and are a part of the Australian Museum Eureka Prizes. The prize's ambassadors are Dr Karl Kruszelnicki AM and Adam Spencer, mathematician and media personality.

The aim of the competition is to present a scientific concept or concepts in a way that is entertaining and accessible to the public. This is generally done by the entries taking the form of a video piece where the content is shown in a creative way. The competition is open to students on an individual or group basis. There are sections for both primary school student and secondary school student entrants.

Many of the videos present their investigations and findings in an extremely entertaining and fun manner. The mantra of the competition 'Learn something without even noticing' is well and truly followed by many of the entries!

Activity (Years 3–10): View previous Sleek Geek Eureka Science School Prize video entries

View previous winning and other video entries for 2012 and previous years at the official website: *www.abc.net.au/science/sleekgeeks/eureka*

Primary entries include:

- Egg-normous! – Winner 2012
- Buckyball Brilliance
- The Scoop on Poop

Secondary entries:

- The Legendary Lizard – Winner 2012
- Natural selection: It's pretty random
- The Colour of Water

COMPETITIONS AND AWARDS – BY STATE AND TERRITORY

The states and territories have a variety of awards and competitions available for school students, teachers and students in higher education to enter and be recognised for their achievements.

Listed are just some of the awards and competitions available in each state and territory. Conduct some research and find some awards or competitions that you, your school or group may be eligible to enter.

Queensland

Peter Doherty Awards for Excellence in Science and Science Education

http://education.qld.gov.au/curriculum/area/science/all-stars.html

The Peter Doherty Awards are named for Professor Peter Doherty, Nobel Prize Winner and Queensland-educated scientist.

The awards recognise students, teachers, support officers, schools, volunteers,

mentors and organisations that have made outstanding and innovative contributions to science and science education in Queensland.

Queensland Junior Physics Olympiad (JPhO)

www.smp.uq.edu.au/jpho

The University of Queensland each year presents Year 9 and 10 Science and Mathematics students with an opportunity to attend a five-day residential program to learn and consolidate problem solving, critical thinking and communication skills, all within the context of physics.

New South Wales

Young Scientist Competition

www.stansw.asn.au/ys

The Young Scientist Competition is a major project run by the Science Teachers Association of New South Wales (STANSW) for NSW school students. The competition asks students from Kindergarten to Year 12 to conduct scientific investigations or make inventions. Students are awarded incentives and teachers are provided with resources to assist their work. The competition is aimed to work in conjunction with an individual school's science program. Winning entries are encouraged to participate in State judging. STANSW recommends the winners of the Young Scientists Awards for the BHP Billiton Science and Engineering Awards.

Victoria

Science Talent Search (STS)

www.sciencevictoria.com.au/sts

The Science Talent Search is an annual, science-based competition open to all primary and secondary students in Victoria, Australia. The STS includes categories for students such as: experimental research, creative writing, working models, inventions, games, computer programs, posters – scientific wall charts, science photography, video productions or a class project for lower primary and primary schools.

Tasmania

UTAS Science and Engineering Investigation Awards

www.picse.net/UTAS/sia.htm

The PICSE UTAS Science Investigation Awards are an investigation-based regional science competition open to any student in Years 5–12 from any school in Tasmania. The competition involves students conducting real-life science investigations to answer a scientific question.

South Australia

Oliphant Science Awards

www.sasta.asn.au/index.php/page/view_by_id/46

The Oliphant Science Awards are South Australia's largest student science competition where students conduct scientific investigations with a real-life focus. Categories include science writing, photography and posters.

Western Australia

Science Talent Search

http://stawa.net/science-talent-search-2011/

The Science Teachers Association of Western Australia conducts the Science Talent Search to promote scientific learning and teaching through project work in West Australian schools.

Northern Territory

Engineers Australia – Youth and Science Programs

www.engineersaustralia.org.au/northern-division/youth-science-programs

Engineers Australia Northern Division and Charles Darwin University, support a range of science challenges, projects and competitions including the Science and Engineering Challenge, Sun Chase and SMART (Science, Math and Real Technology).

State and Territory Science Teachers Associations

The Science Teachers Associations in each state provide information, resources, programs, professional development and support to teachers and students in each state in Australia.

Each association also offers information on a range of competitions conducted over each year that are open to school students. These awards and competitions recognise student achievement and proficiency in a variety of areas. They include competitions such as the RACI Chemical Analysis (Titration) Competition or the RACI Crystal Growing Competition.

Check your state's Science Teacher's Association's website for information on the competitions, fairs and the eligibility for each.

Australian Science Teachers Association (ASTA): *http://asta.edu.au*

Queensland (STAQ): *www.staq.qld.edu.au*

Science Fairs and competitions: *www.staq.qld.edu.au/science-fairs-and-competitions*

New South Wales (STANSW): *www.stansw.asn.au*

Victoria (STAV): *http://stav.vic.edu.au/home*

Tasmania (STAT): *www.stat.org.au*

South Australia (SASTA): *www.sasta.asn.au*

Western Australia (STAWA): *http://stawa.net*

Northern Territory (STANT): *www.stant.asn.au*

Ideas for Science Fairs and Competitions

Are you stuck for ideas for Science Fairs and Competitions? Try the following websites to get some cool ideas and projects for you to have a go at!

Do it Yourself Science - CSIRO: *www.csiro.au/Portals/Education/Programs/Do-it-yourself-science.aspx*

CSIRO – Project ideas: *www.csiro.au/en/Portals/Education/Teachers/Classroom-activities/CREST/Project-ideas.aspx*

Fizzics Education – Free Science Experiments and Project ideas: *www.fizzicseducation.com.au/experiments/free_experiments.html*

Science Buddies: *www.sciencebuddies.org/science-fair-projects/project_ideas.shtml*

Science Bob – Science Fair Ideas: *www.sciencebob.com/sciencefair/ideas.php*

CURRICULUM MAP

Science as a Human Endeavour Strand – Curriculum Map

The research of the scientists and innovators mentioned in this book is mapped against the SHE content descriptions of the Australian Curriculum: Science to aid teachers in the selection of scientists and related activities for their students to study.

Year 1	
ACSHE 022 People use science in their daily lives, including when caring for their environment and living things	Dr Yvonne Aitken John McConnell Black Dr Winifred Curtis Professor Walter Lawry Waterhouse Dr Isobel Bennett Dr Saul Weiner Helen Brookes Professor Adrienne Clarke Dr Douglas Waterhouse Sir Howard Florey
Year 2	
ACSHE 035 People use science in their daily lives, including when caring for their environment and living things	Dr Alf Howard Dr Isobel Bennett Helen Brookes Dr John Phillips Bill Mollison Jim Frazier Professor Amanda Lynch Sir Howard Florey
Year 3	
ACSHE 051 Science knowledge helps people to understand the effect of their actions	Charlotte Morrison Anderson Dr Yvonne Aitken John McGarvie Smith Dr Gwynneth Vaughan-Buchanan John McConnell Black Sir Norman Gregg Dr Winifred Curtis Dr Isobel Curtis Dame Kate Campbell Dr Saul Weiner Dr Robin Bedding Helen Brookes Dr John Phillips Arthur Bishop Bill Mollison Professor Adrienne Clark Dr Douglas Waterhouse

Year 4	
ACSHE 062 Science knowledge helps people to understand the effect of their actions	Dr Alf Howard Professor Frank Fenner Dr Roger Norse Bill Mollison Dr Douglas Waterhouse Dr Robert Gilbert Jim Frazier Dr Karen Kozielski
Year 5	
ACSHE 082 Important contributions to the advancement of science have been made by people from a range of cultures	William Crooke Ruby Payne-Scott Professor Bernard Mills J Paul Wild Professor Ronald Bracewell
Year 6	
ACSHE 099 Important contributions to the advancement of science have been made by people from a range of cultures	Professor Ernst Willington Skeats Professor Ken Campbell Dr Adrien Albert Dr Roger Norse Dr Karen Kozielski Dr Victoria Haritos
ACSHE 220 Scientific knowledge is used to inform personal and community decisions	John MacGarvie Smith William Crooke Sir William Clunies-Ross Dr Albert Pugsley Professor Alan Parker Dr David de May Warren Dr Roger Norse Dr Ian McWilliam Dr Colin Nexhip Bill Mollison Professor Ted Ringwood Dr Paul Fraser Professor Jennie Brand-Miller Professor Alan Trounson Dr John O'Sullivan Professor Amanda Lynch Dr Jane Hodgkinson Dr Karen Kozielski Professor Suzanne Cory Dr Peter Coppin Dr Victora Haritos Sir Howard Florey

Year 7	
ACSHE 119 Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world	William Crooke Ruby Payne-Scott J Paul Wild Professor Ronald Bracewell Sir Douglas Mawson Sir David Orme Masson Professor David Craig William Crooke Professor Bruce Holloway Sir Noel Bayliss Professor Dorothy Hill Professor Victor Bailey Dr Brian Schmidt Sir Howard Florey Sir William Lawrence Bragg Sir William Henry Bragg
ACSHE 223 Science knowledge can develop through collaboration and connecting ideas across the disciplines of science	Dr Mark Lidewell Professor Walter Lawry Waterhouse Professor Frank Fenner Dr David De May Warren Dr Roger Norse Helen Brookes Dr John Phillips Dr Colin Nexhip Bill Mollison Dr Douglas Waterhouse Dr Karen Kozielski Dr Peter Coppin
ACSHE 120 Science and technology contribute to finding solutions to a range of contemporary issues□ these solutions may impact on other areas of society and involve ethical considerations	Dr Mark Lidewell Professor Walter Lawry Waterhouse Professor Frank Fenner Dr David De May Warren Dr Roger Norse Helen Brookes Dr John Phillips Dr Colin Nexhip Bill Mollison Dr Douglas Waterhouse Dr Karen Kozielski Dr Peter Coppin
ACSHE 121 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management	Dr Ian Wark Dr Ian McWilliam Professor Donald Metcalf Professor Ted Ringwood

ACSHE 224 People use understanding and skills from across the disciplines of science in their occupations	Dr Alf Howard Dr John Phillips Dr Jane Hodgkinson Dr Allan Hahn
Year 8	
ACSHE 134 Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world	Dr Cyril Callister Professor David Curtis Dr Winifred Curtis Dr Arthur Birch Dr John Cade Dame Kate Campbell Dr Saul Weiner Professor Gordon Ada Professor Donald Metcalf Dr Henry Harris Dr Mark Shackleton Professor Alan Trounson Professor Suzanne Cory Dr Brian Schmidt Sir Howard Florey Sir William Lawrence Bragg Sir William Henry Bragg
ACSHE 226 Science knowledge can develop through collaboration and connecting ideas across the disciplines of science	Charlotte Morrison Anderson Professor Ernst Willington Skeats John MacGarvie Smith Gwynneth Vaughan-Buchanan Professor David Curtis Professor Bruce Holloway Dr Arthur Birch Sir Alan Walsh Dr Saul Weiner Professor Gordon Ada Dr Charlotte Anderson Professor Donald Metcalf Dr Basil Hetzel Dr Henry Harris Dr Collin Nexhip Dr Mark Shackleton Professor Graeme Clark Dr Colin Sullivan Stephen Graeme Professor Fiona Wood Professor Ray Cas

ACSHE 135 Science and technology contribute to finding solutions to a range of contemporary issues□ these solutions may impact on other areas of society and involve ethical considerations	Professor Frank Fenner Dr David De May Warren Dr Robin Bedding Arthur Bishop Bill Mollison Dr Victoria Haritos Dr Elizabeth Blackburn Dr Barry Marshall Dr Robin Warren
ACSHE 136 Science understandings influence the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management	Dr John Phillips Bill Mollison Professor Adrienne Clark Professor Amanda Lynch Dr Yvonne Aitken Sir William Clunies-Ross Professor Bruce Holloway Arthur Turner Dr Albert Pugsley Dr Walter Lawry Waterhouse Professor Frank Fenner Dr Robin Bedding Helen Brookes Dr John Cornforth
ACSHE 227 People use understanding and skills from across the disciplines of science in their occupations	Dr Isobel Bennett Dr John Cade Professor Frank Fenner Dr Ian McWilliam Professor Gordon Ada Dr Robin Bedding Helen Brookes Dr John Phillips Dr Henry Harris Dr Colin Nexhip Dr Mark Shackleton Arthur Bishop Professor Ian Ross George Nicholas Dr Cyril Callister Professor Bruce Holloway Arthur Turner Dr Albert Pugsley Sir Noel Bayliss Dr Arthur Birch Professor Fiona Stanley Bill Mollison

ACSHE 227 cont.	Professor Ted Ringwood Professor Alan Trounson Dr Robert Gilbert Professor Fiona Wood Dr Karen Kozielski Professor Martin Banwell Dr Peter Coppin Dr Victoria Haritos Sir Frank MacFarlene Burnet Sir Howard Florey
Year 9	
ACSHE 157 Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community	Professor Frank Fenner Dame Kate Campbell Sir Alan Welsh Sir Ronald Nyholm Dr Henry Harris Professor Ian Ross Dr Steve Wilkins Professor Ray Cas Dr Jane Hodgkinson John MacGarvie Smith Dr Ian Wark Professor Ken Campbell Dr Hedley Marsten Sir Noel Bayliss Dr Adrian Albert Sir Norman Gregg Sir Marcus Oliphant Dr Joan Freeman Dr Brian Schmidt Sir William Lawrence Bragg Sir William Henry Bragg
ACSHE 158 Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries	Professor Ken Campbell Professor Victor Bailey Dame Kate Campbell Dr David Robinson Professor Brian Anderson Professor Ronald Bracewell Dr Steve Wilkins Dr John O'Sullivan Professor Suzanne Grey Dr Allan Hahn

ACSHE 160 People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions	Dr Charlotte Bedding Dr John Phillips Bill Mollison Professor Jennie Brand-Miller
ACSHE 161 Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities	Charlotte Morrison Anderson Dr Ian Wark Professor Bill Compston Ruby Payne-Scott Professor Victor Bailey Professor Bernard Mills Dame Kate Campbell Dr David Robinson Dr Henry Harris Dr Mark Shackleton Professor Brian Anderson Professor Graeme Clark Dr Rodney Brooks Jim Frazier Dr Bernard Katz
ACSHE 228 The values and needs of contemporary society can influence the focus of scientific research	Professor Fiona Stanley Dr Roger Norse Dr Ian McWilliam J Paul Wild Bill Mollison Professor Brian Anderson Dr Paul Fraser Professor Fiona Wood Dr Karen Kozielski Sir William Clunies-Ross Dr Ian Wark Arthur Turner Professor Alan Parker Dr Adrien Albert Dr Elizabeth Blackburn Dr Barry Marshall Dr Robin Warren Dr Peter Doherty Dr John Cornforth Dr Bernard Katz Dr John Eccles Sir Frank MacFarlene Burnet

Year 10	
ACSHE 191 Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community	Dr Arthur Birch Professor Fiona Stanley Sir Ronald Nyholm Dr Saul Weiner Professor Bernard Mills Professor Ken Freeman Dr Paul Fraser Professor Ronald Bracewell Professor Raymond Dart Professor Ray Cas Dr Jane Hodgkinson Professor Suzanne Cory Dr Brian Schmidt Sir William Lawrence Bragg Sir William Henry Bragg
ACSHE 192 Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries	William Ernst Crooke Dr Alf Howard Professor Frank Fenner Dr Ian McWilliam Dr Robin Bedding J Paul Wild Professor Brian Anderson Professor Alan Trounson Dr Steve Wilkins Dr John O'Sullivan Professor Amanda Lynch Dr Peter Doherty Dr John Cornforth Sir William Lawrence Bragg Sir William Henry Bragg
ACSHE 194 People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions	Dr Hedley Marston Dr Charlotte Anderson J Paul Wild Bill Mollison
ACSHE 195 Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities	Professor David Craig Professor David Metcalf Dr Henry Harris Dr Mark Shackleton Arthur Bishop Professor Ted Ringwood Professor Brian Anderson Professor Alan Trounson Dr Rodney Brooks Dr John O'Sullivan Professor Suzanne Cory Dr Peter Coppin Dr Victoria Haritos Dr Elizabeth Blackburn Dr Peter Doherty