Providing support and promoting excellence in science education

# SciTalk

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Number 1– February 2018

## Keeping up-to-date with new Science

Science and technology are changing our world at an astonishing pace – with internet, mobile devices and social media changing how we communicate and get information about the world. As William Gibson, the science fiction author who coined the term 'cyberspace', said:

> "Some of the most important changes in the future will come not from a new technology, but from a larger number of people having access to something that already exists."

The challenge for Science teachers is to keep up-to-date at all times, as well as having syllabus awareness, so that we can guide our students in the learning process and to better equip them to live in the future world. Students must learn how to access the most up-to-date information. Remember, syllabuses are no longer considered 'static' documents, but rather 'living' and hence evolving, as they can be changed as needed in the light of new discoveries.

Teachers need to be aware of recent discoveries, as it can take years before they reach textbooks. Hence the importance of using reliable internet resources for research to keep up-to-date.

One recent discovery that scientists have now observed in the wild, is that a new species can arise in only three generations. Yet for nearly 160 years, since Darwin published his book 'On the origin of species', the concept of evolutionary change has been that it was very slow, occurring over hundreds of generations. So this will have to change how we teach evolution.

Professors Rosemary and Peter Grant from Princeton, studied Darwin's finches on the island of Daphne Major in the Galápagos archipelago from 1973–2012. Over this period, they observed the pairing up of two birds from different species and then followed what happened to see how speciation occurred.

During their frequent expeditions to the island, they tagged roughly 20,000 birds over at least eight generations. They tracked almost every mating and its offspring, and so were able to create large, multigenerational pedigrees for different finch species. They took blood samples and recorded the finches' songs, which allowed them to track genetics and other factors long after the birds themselves died.

Genomic sequencing and the analysis of physical characteristics has now confirmed that the arrival of a 'strange' immigrant bird to Daphne Major in 1981 led to a new species of Darwin's finch (termed 'Big Bird' by the researchers), that today consists of roughly 30 individuals. The immigrant cactus finch has been identified as a *Geospiza conirostris* male from the island of Española >100 km from Daphne. It bred with a resident finch (*G. fortis*). From the F2 generation onwards, the lineage only bred amongst themselves, and was ecologically successful, despite intense inbreeding.

This new species is reproductively isolated from the other three species on the island. They are larger, have a different beak size and shape and a different bird song – but their isolation from the other ancestral species, *G. conirostris* is yet to be tested.

References: • *Science 23 Nov 2017 (AAAS)*
• *www.sciencedaily.com (Princeton Uni)*

★ *2018 editions Past HSC Questions & Worked Solutions ... see p7* ★

## INSIDE THIS ISSUE ▸▸▸▸



### ★★ ATTENTION ★★

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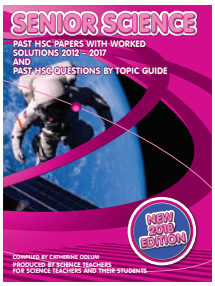


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**TO WIN:** Send your name, school & school address to Book Giveaway, PO Box 442, Freshwater 2096 OR by email to *cathie@odlumgarner.com.au* – **by 13 April 2018**

★ ★ ★

Winner for ***SciTalk 2/17***

Narelle Valentine, Georges River Grammar, won *Blitzing Biology (rrp $49.95) by Katrina Garner*, published and donated by Blitzing Publications.

# Diary Dates

* Shell Questacon Science Circus – NSW dates: 20-25 March, 29 May-24 June, plus Albury in Oct/Nov. For more information, go to: questacon.edu.au/outreach/programs/science-circus
* Nyholm Lecture series – aimed at Years 9 & 10. racichemedcentral.com.au/other-initiatives

**FEBRUARY 2018**

22 Depth studies day. Enquiries: Human Disease Museum, UNSW

**MARCH 2018**

2 Schools' Clean Up Australia Day. cleanupaustraliaday.org.au/about/about-the-event/

4 Clean Up Australia Day. cleanupaustraliaday.org.au/about/about-the-event/

14 & 15 NeuroBLAST Brain careers days. Enquiries: Human Disease Museum, UNSW

16, 19, 23 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

21 Autumn Equinox (03:15 am AEDT)

all Tm 2 NSW Crystal Growing Competition - start growing crystals are to be grown in Term 2

**APRIL 2018**

9, 13 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

12 &13 PD Days: Biology, Investigating Science & Depth Studies. Human Disease Museum, UNSW

22 International Earth Day. www.earthday.org

30 Immunology Day: Human Disease Museum, UNSW

**MAY 2018**

7, 11, 18, 21, 28 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

17 ANSTO Teacher PD Day: Nuclear science for Yr 9/10 & Depth studies for senior courses

b/w 9–16 Big Science Competition. Closing date: 2/5/18. www.asi.edu.au/programs Ph: 6125 6228

tba Astronomy Open Night: Macquarie Uni, 6:30–10 pm, details/tickets at www.mq.edu.au/

**JUNE 2018**

tbc NSW Schools Titration Competition. Entries close in May. raci.org.au/branches/nsw-branch

1, 4, 8, 15, 18 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

5 World Environment Day. www.un.org/en/events/environmentday/

21 Winter Solstice (08:07 pm AEST)

30 (tbc) Close date Crystal Growing Competition (grow in Tm 2): raci.org.au/branches/nsw-branch

**JULY 2018**

5 & 6 Zombie Apocalypse Junior Science event: Human Disease Museum, UNSW

8–11 ASTA CONASTA 67. Theme: *Spotlight on Our Future*. Venue: Sydney University.

11–14 Curious Minds Program – Winter camp for Yr 9/10 girls interested in STEM. www.asi.edu.au

**AUGUST 2018**

2 ANCQ – chemistry quiz for students, registrations close 8 June. www.raci.org.au/education/ancq

3 Jeans for Genes Day. www.jeansforgenes.org.au/

8 Chemistry Olympiad Exam. Closing date: 18/7/18. Ph: 6201 2552, asi.edu.au/programs

10 Earth Science Olympiad Exam. Closing date: 18/7/18. Ph: 6201 2552, asi.edu.au/programs

13 Biology Olympiad Exam. Closing date: 18/7/18. Ph: 6201 2552, asi.edu.au/programs

15 Physics Olympiad Exam. Closing date: 18/7/18. Ph: 6201 2552, asi.edu.au/programs

10, 13, 17 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107 – come on one of these dates to celebrate National Science Week

11–19 National Science Week. 'Game Changers & Change Makers'. www.scienceweek.net.au/schools/

**SEPTEMBER 2018**

tba National Schools Titration Competition. raci.org.au/branches/nsw-branch

4–10 Seaweek 2018. www.aaee.org.au/seaweek/ & www.aaee.org.au/seaweek-resources/

10, 14 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

23 Spring equinox (11:54 am AEST)

**OCTOBER 2018**

19, 22, 26, 29 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

**NOVEMBER 2018**

2, 5, 16, 19 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

23, 26, 30 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

**DECEMBER 2018**

3–19 Beyond the Thrills at Luna Park Sydney. www.beyondthethrills.com.au ph (02) 9939 6107

4 ANSTO Teacher PD Day: Nuclear science for Yr 9/10 & Depth studies for senior courses

22 Summer solstice (09:22 am AEDT)

**JANUARY 2019** National Youth Science Forum. Forms to local Rotary club by 31/5/18, interviews from July. Only for Yr 11 in 2018. Enquiries: 6125 2777, email: nsss@anu.au, www.nysf.edu.au/

*While all dates have been checked to ensure that information in DIARY DATES is correct, no responsibility will be accepted by the publisher or Editor for any omissions or inaccuracies in it.*

## Update on NESA matters

Make sure that you regularly check NESA's website at: *educationstandards.nsw.edu.au* to ensure that you have the latest information on syllabuses, past exam papers, news, official notices, statistics archive and more.

You need to be aware that syllabuses must be constantly checked now, as clarifications and amendments can occur at any time – to ensure that you are teaching the correct work. Make sure that from 2018 on, you are teaching the new Stage 6 syllabuses to Year 11. These will be examined for the first time in the 2019 HSC. The HSC exams in 2018 will be the last set of exams based on the old Science syllabuses.

Some **NESA official notices**/media release from 2017 that you need to be aware of:

- *New Science & Technology K–6 Syllabus* [Media release: 12-12-2017]
- *New Stage 6 Science Extension Syllabus* [1-12-2017]
- *Requirements for schools selected randomly for inspection in 2018* [24-11-17]
- *New Stage 6 syllabuses, assessment requirements and examinations* [6-10-17] Examination specifications and sample examination materials.

… **plus these earlier ones:**

- *Errata - new Biology & Physics Syllabuses for implementation with Year 11 from 2018* [8-9-17]
- *Changes to Stage 6 Science Pattern and Pathways of Study* [21-6-17] From the 2019 HSC exam onwards, students can study up to 7 units of Science in Year 12.
- *Clarification - New Physics Stage 6 Syllabus for implementation with Year 11, 2018* [25-8-17]
- *Clarifications and errata - new Biology, Chemistry and Physics Stage 6 Syllabuses for implementation with Year 11, 2018* [30-3-16]

Remember, you can get weekly emails from NESA to keep you abreast of NESA matters.

**NESA enquiries:**
Ph: 9367 8111, fax: 9367 8484
*educationstandards.nsw.edu.au*

**Science contact:** Kerry Sheehan
Senior Inspector and Inspector Science
kerry.sheehan@nesa.nsw.edu.au

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* * * * *

Thank you to all the teachers who support these projects.

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A visit to us will transform your students. They will connect with the content in amazing ways and talk about this for the rest of the year.

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*Meet an expert* (Years 5-12)
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- Lots of experts, dates and times to choose from

*Nuclear Science Inquiry Skills* (Years 7-12)
- Students design and perform a first-hand investigation of radiation using equipment they don't have at school
- Book during your normal class time

**Bookings and information:**
Website: www.ansto.gov.au/education
Email: tours@ansto.gov.au
Phone: (02) 9717 3090
Location: New Illawarra Rd, Lucas Heights

## Beyond the Thrills

Our prices for school excursions to Luna Park Sydney in 2018 are the **lowest available @ $28 per student** and our booking fee is also the lowest, at only a low $25 per school.

Any school or any school faculty can come for just a fun day **OR** we can provide a set of curriculum-based worksheets (if required) for an educational excursion.

These excursions will provide your students with a great action-packed fun day.

For more details and bookings, go to:

**www.beyondthethrills.com.au**
T: (02) 9939 6107 E: robert@beyondthethrills.com.au

## SHIPWRECKS, CORROSION & CONSERVATION
### STAGE 6 CHEMISTRY

This program relates to the *Shipwrecks, Corrosion and Conservation* option. Students attend an AV presentation on conservation and restoration, including footage taken during the recovery of material from HMS *Bounty*. Students then participate in a hands-on workshop focusing on desalination of metal objects, metal and corrosion product identification, methods of protecting metals and rates of corrosion.

This is followed by a guided tour of shipwreck material in the museum. Students may also visit the destroyer HMAS *Vampire* and submarine HMAS *Onslow*.

Program is 4 hours, at a cost of $22.00 per student (teachers free).

**Bookings & Information:**
Phone: 02 9298 3655 Fax: 02 9298 3660
Email: bookings@anmm.gov.au
Location: 2 Murray Street, Sydney 2000
Website: www.anmm.gov.au/

AUSTRALIAN NATIONAL MARITIME MUSEUM

## National Science Week
**11–19 August 2018**

Why not bring Science Week into your school and participate in this annual event, so that your students can enjoy and explore the wonders and benefits of Science. You may prefer to celebrate 2018 National Science Week by going on a Science excursion to a museum or discovery centre.

You could go on a *Beyond the Thrills* excursion to Luna Park Sydney on 10, 13 or 17 August 2018, or to one of the other excursion venues on this page for National Science Week.

The 2018 schools' theme is *Game Changers and Change Makers* – celebrating and exploring science, innovation and technology. This theme could refer to individuals, teams, technologies or ideas – what does it suggest to you?

## New danger in lightning

The discovery and proof that thunderstorms can trigger nuclear reactions provides new insight into the physics of atmospheric electricity and unveils a previously predicted, but unproven, natural source of radioactive isotopes on Earth.

Scientists at Kyoto University in Japan have used radiation detectors to pick up neutron and positron signals from a thunderstorm in mid-2017. This phenomenon had been predicted as long ago as 1925. However, this was before the discovery of the neutron by Chadwick in 1932. So a mechanism for the process was unknown at the time.

In 1994, NASA picked up bright bursts of gamma rays coming from Earth using its orbiting Compton Gamma Ray observatory. These gamma rays were thought to originate in intense thunderstorm cells and were generated by lightning. Scientists subsequently sent planes into storms with detecting apparatus to show that this was their source.

The Kyoto team have now proved this to be the case by detecting the strong gamma ray spectral line corresponding to annihilation of an electron and a positron in the gamma ray spectrum from thunderstorms. Intense electric fields generated by lightning can accelerate electrons to ultra-high energies causing them to emit intense gamma rays. These gamma rays can then collide with molecules in the atmosphere causing reactions such as the excitation of normal nitrogen-14 atoms causing them to undergo transmutation to carbon-13, with the emission of a position and a neutron. A similar process can lead to transmutation of O-16 to N-15.

Physicists have long been concerned about radiation hazards for air passengers during lightning. However, pilots usually divert their planes to avoid unstable atmospheric conditions, such as thunderstorms. As a result, their passengers are not exposed to this added radiation in the stratosphere!

*References*: • *Nature 22 November 2017*


**Note**: Contrary to common practice, the UN has not declared 2018 as an International Year for any specific topic.

## Teaching about biodiversity

Teaching students about biodiversity, or the variety of life on Earth, is a daunting yet exciting task. You will find some great, free education resources for 5–18 year olds from ARKive Education. These cover a range of key science and biology subjects including: adaptation, endangered species, food chains, Darwin and natural selection, classification, identification, conservation and biodiversity. They include: classroom presentations, activities and handouts, teachers' notes, as well as links to ARKive species profiles and scrapbooks. You will find these at:

*www.arkive.org/education/*

This year, being 2018, is still a part of the **UN Decade on Biodiversity** – that runs from 2011–2020. Science teachers should promote activities that encourage our living in harmony with nature. Education is essential for the sustainable and equitable use of biodiversity and its conservation. Our survival on Earth depends on the maintenance of biodiversity in all ecosystems … as illustrated on the left.

United Nations Decade on Biodiversity

## School & chemical education activities in 2018

### Crystal Growing Competition

Primary and Secondary students in years K–6 & 7–12.

Enter the RACI NSW Crystal Growing Competition and learn all about growing beautiful crystals.

Crystals are grown during Term 2.

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raci
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**Website**: www.raci.org.au/branches/nsw-branch

**Email**: raci-nsw@raci.org.au

**NSW Branch Office Ph: (02) 9663 4960**

### Titration Competition

A competition for Year 11 & 12 students.

Registrations open: **12 March 2018**.

NSW Competition held June 2018.

National Competition held September 2018.

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*Does your school want to be a venue for 2018?*

### ANCQ

(formerly the Australian National Chemistry Quiz)

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### Nyholm Youth Lectures

Aimed at Year 9 & 10 students.

'*Linked to the 7-10 Science syllabus and delivered by inspiring role models.*'

**Dr Alice Williamson** – USyd '*Mother Nature's Molecule – the good, the bad and the ugly*'

***Dr Nial Wheate*** – USyd *'Real or counterfeit medicines, you decide…'*

*Does your school want to be a venue for 2018?*

## National Science Week
## 11 – 19 August 2018

This year's schools' theme is *Game Changers and Change Makers*. The focus by ASTA (Australian Science Teachers' Association) this year will be on people who are making great changes to the way we live – including scientists, engineers, technologists, mathematicians, designers and innovators of the past and present – not just famous scientists!

Each year, ASTA produces a **resource book** to support and assist teachers in providing engaging science activities for their students. The **2018 resource book** for *Game Changers and Change Makers* will be an e-book available in April 2018. Go to: *asta.edu.au/programs/natscienceweek* The book will be inspired by three events:

• 2018 being the International Year of the Reef (and so will look at coral reefs and the scientists who study them),

• 2018 being the 40th anniversary of the birth of the first test tube baby (so fields such as genetic engineering, biotechnology, nanotechnology will be investigated), and

• 2018 being the 200th anniversary of the publication of Mary Shelley's *Frankenstein* (so it will look at genetic engineering, biotechnologies, prosthetics, bionics, genetic modification, brain enhancement and ethics)

Around 1000 events take place around Australia during National Science Week each year – and are offered by universities, schools, museums and science centres. Around 160,000 people take part in school activities. Schools around the nation celebrate this week by organising and participating in a diverse range of activities and events to enthuse their students' interest in science and to encourage them to become fascinated by the world we live in.

## Predictions, discovery and proof can take time

In 1862, Charles Darwin, famed for his theory of evolution, made observations of a species of orchid, *Angraecum sesquipedale*, that was endemic to Madgascar. He saw that the star-shaped flower had an exceptionally long nectary (around 30 cm) – this receptacle holds the flower's nectar.

Darwin, who is also famous for his studies of orchids and the mechanisms by which they were pollinated, made two bold predictions based on his understanding of evolution, and the ecology of orchids and insects:

- that an as-yet undiscovered species of moth would exist with a long proboscis that would be able to reach the nectar that collected at the base of the nectar spur
- that the orchid's long nectary evolved alongside a moth with an exceptionally long tongue to pollinate it.

It took nearly 150 years to prove that these 1862 suggestions by Darwin were correct.

While we now recognise the idea of such co-evolution to be common and well known (and indeed, the pollinator-flower interactions are a great example of this), it was at the time a novel suggestion. Darwin developed his ideas on co-evolution as he studied variation in the flower structure of orchids and variations in the structure of specific insect pollinators – particularly when there was a 1:1 relationship between the flower and its pollinator.

In 1903, long after Darwin's death, the eccentric banking multimillionaire, Baron Lionel de Rothschild, mounted an expedition to Madagascar that discovered Darwin's predicted moth, *Xanthopan morganii preadicta*. As expected, the moths are large with wingspans of about 150 mm and proboscises of about 300 mm. However, the moth was never observed visiting or pollinating the orchid then, nor in the hundred years that followed.

In 1992, 130 years after Darwin's initial prediction, a male *X. morganii praedicta* was captured bearing a viscidium of *A. sesquipedale*. A viscidium is a disc-shaped structure, found on orchids, that sticks to a visiting insect. It wasn't direct evidence, but it was close.

Figure 1 Darwin's moth, *Xanthopan morganii praedicta*, with its long proboscis

[Credit: kqedquest | CC BY-NC 2.0]

Then in the same year, using night-vision equipment, researchers obtained the first ever photographic evidence of *X. morganii praedicta* visiting the orchid. And in 2004, 143 years after Darwin's predictions, video evidence of the moth feeding from and pollinating *A. sesquipedale* was recorded. Darwin would have been pleased.

Figure 2 Darwin's orchid, *Angraecum sesquipedale*

[Credit: Smithsonian Gardens Collection]

*References:*

- *NewScientist 4 Nov 2017* • *Science (AAAS) – 23 Sep 2011* • *www.theguardian.com*
- Robbie Gonzalez (2005). 'Darwin Predicted This Animal's Existence Decades Before Its Discovery'

## Antarctic ice shelves going, going, ...

For millions of years, snow falling on the Antarctic continent has been accumulating into great sheets of ice, and in places it is over three kilometres thick. Only the highest of Antarctica's mountains poke through this ice to reach above it. Everywhere, the ice flows towards sea level in glaciers that usually terminate in ice sheets floating in coastal bays around the continent. The floating ice sheets normally act as a brake on the flow of glaciers that feed them. These 'ice shelves' usually grow in winter and retreat in summer.

In recent years, glaciologists have observed a new phenomenon when visiting several Antarctic ice sheets. The ice sheets are melting from their lower surface, as warmer water from the north flows in under the ice. This thins the ice shelf and causes fractures to develop. Hence the ice shelf breaks up.

The ice shelf at the base of the Pine Island glacier developed an initial fissure in mid-2015 – nearly 20 km back from its edge. A second crack formed nearly 27 km back from the terminal face of the ice shelf. Within a year of the first crack forming, nearly 600 sq km of the ice shelf had broken up into hundreds of icebergs that floated away and melted.

The melting of this floating ice does not change sea levels – as the ice is already in the sea floating on its surface. However, what follows is likely to lead to a disaster. The loss of the ice shelf allows the glacier that is held behind it to move downhill more quickly, as melt water lubricates the interface between the bed rock and the ice. Glaciers have been measured moving at rates of up to 4 km per year. Their terminal face will break up, adding new icebergs to the ocean. Since this is ice that was originally on land and is now in the ocean, its melting will cause sea levels to rise.

*References*: • *National Geographic 2 Dec 2017*

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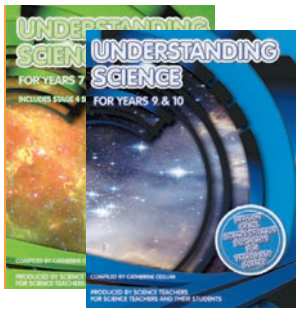


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## RACI Crystal Growing Competition 2018

Crystals are everywhere. Just think of our daily lives – sugar and salt are crystals and the only reason LCD computer and television screens work is because of the many tiny crystals inside.

Where else can you find crystals? How about your classroom? Why not enter the RACI Crystal Growing Competition and learn all about growing beautiful crystals.

This competition takes place in Term 2 and is open to both primary (K-6) and secondary (7-8) students to grow single crystals of alum, and K-10 students can grow any crystal.

Crystals are to be grown for no longer than 6 weeks – and must be at the RACI office by the closing date: Friday 29 June 2018.

The best crystals will be sent to the National Crystal Growing Competition (judged in Term 4).

Details and entry forms: *www.raci.org.au/branches/nsw-branch*

Contact: Jenny Jones, jennyjonesdr@gmail.com

## Unlocking the secrets of autism

The word 'spectrum' is used to describe autism because the condition expresses itself in many ways and intensities. However, scientists hope that a new approach might offer a medical treatment for its most isolating symptoms.

From a beckoning index finger or slight tilt of the head to an expectant facial expression and direct eye contact, there are many ways that you can signal for a child to walk towards you. Our social world is so full of these subtle signs that our brain barely registers the huge number we receive in a day. Rather, we react to them automatically, as if speaking an inherent language.

For about one in every 88 children, the ability to recognise these non-verbal signs of communication is not in-built – they don't understand the language. In fact, for these people, the process of interpreting and then responding to a sign can be overwhelming, frustrating and confusing – and they are said to have a lifelong developmental condition called autism spectrum disorder.

Professor Adam Guastella from Sydney University's Brain and Mind Centre has studied autism spectrum conditions for more than 10 years. "When I first trained as a psychologist in the mid-1990s there was a view that there wasn't much you could do for autism," Professor Guastella remembers. Early intervention and therapies can dramatically improve outcomes for people with autism, and these approaches were common at the time. However, any sort of medical treatment targeting social behaviour was uncharted territory.

In 2015, a breakthrough clinical trial, led by Professor Guastella, with 31 autism-affected children aged between three and eight challenged that view. This trial used a nasal spray to administer a synthetic oxytocin. The trial lasted five weeks and used a crossover design – meaning that, at times, every child also received a placebo.

During childbirth, oxytocin is the hormone that signals the womb to start contracting during birth. But it has another function. Oxytocin promotes mother-child bonding, and for humans in general, it underpins emotional bonding and social connection – processes that people with autism find difficult to navigate. The results were encouraging, as about 30% of the children benefitted. The parents were overjoyed. One said: "It's helped my child to bring things together and to make sense of things to respond more accurately." Another said: "My child is able to put things together so much more effectively than before."

Autism is a mysterious condition. Despite what might be said in parliament or on social media, there is one certainty – autism is not caused by vaccinations. What actually does cause it is still unknown, except for some strong indicators that it is genetic. In the 1950s and 1960s, there were other ideas, e.g. that parental coldness caused the child to withdraw and become autistic. The term 'refrigerator mother' was unfairly applied to mothers with children who might have some very challenging behaviours.

The first sign of autism might be delayed language, with about 40% of such children never speaking at all. People with autism commonly have a strong preference for set routines and dislike change. They can also have repetitive behaviours or develop obsessive interests and become highly skilled or knowledgeable in a niche subject. Autism is four times more common in boys than girls, which again suggests a genetic link. However, autism expresses itself differently in every individual. Some struggle with understanding others' emotions. Others struggle with new environments or new experiences.

Today, the definition of autism is evolving to encompass conditions like Asperger's syndrome, which used to be seen as similar, but separate. People with Asperger's don't have childhood language issues and in fact can be highly articulate from a young age. Even though they might be gregarious by nature, it can be hard for them to 'fit in'. They also have obsessive qualities.

Many prolific artists and ground-breaking scientists throughout history were thought to have been on the autism spectrum, including Michelangelo, Stanley Kubrick, Mozart and Albert Einstein.

While the expression of autism varies from person to person and within different contexts, research shows that the right environment and support can make a world of difference. Professor Adam Guastella and his team see people from age 2–50, with a view to minimising the social effects that their autism has on them.

Their interest in the neurobiology of social learning led to investigating oxytocin. Numerous trials over almost a decade have shown that oxytocin can increase eye gaze, the encoding of social memories and emotional recognition.

It is still early days for the oxytocin treatment, with key questions still to be answered. For example, why did the trial work for some children and not others? Upcoming clinical trials will look for an answer. One will see if oxytocin's effectiveness would be improved by administering a potentially more effective oxytocin stimulant through subcutaneous injection. Another will put a marker on the oxytocin molecules so researchers can track each individual molecule to better understand areas of the brain to target.

*by Katie Booth*

[Adapted reprint of the original text and used with permission from *SAM, Issue 5 Oct 2017*]

## Little floating objects in our field of vision

The little black dots and shapes we see in our vision are due to condensations in the vitreous gel. They often move across the vision when reading or doing computer work and annoyingly continue to move after the eyes come to rest.

This is because the floaters are in the vitreous gel that continues to move after the eyes stop. Vitreous gel is clear and fills the eyeball between the lens and the retina. We all have floaters – however, if lots of new ones suddenly appear, particularly large floaters, this can be a sign of a retinal detachment occurring and the cause should be investigated by an eye specialist.

*Assoc Prof John Grigg from the University of Sydney's Save Sight Institute*

[Reprinted with permission from *SAM, Issue 5 Oct 2017*]

## Discovery of a twin to our solar system

Astronomers in the US have spotted an eighth planet circling the star Kepler-90, which is 2545 light-years from Earth … making it a 'twin' to our solar system. The new planet was discovered in data from NASA's Kepler Space Telescope. All the planets around the Kepler-90 orbit closer than Earth does to the Sun.

The newly-discovered Kepler-90i – a sizzling hot, rocky planet that orbits its star once every 14.4 days – was found using machine learning from Google. Machine learning is an approach to artificial intelligence in which computers 'learn'. In this case, computers learned to identify planets by finding instances in the Kepler data in which the telescope had recorded changes in starlight caused by exoplanets.

An exoplanet is a planet beyond our solar system that orbits a star. The first exoplanets were only discovered about two decades ago in 1992. To date, 3572 exoplanets have been discovered and considered 'confirmed'. Over 2000 further objects have been identified as potential exoplanets. However, these require further observations for confirmation. NASA's Kepler Space telescope, launched in 2003, has been responsible for most of these discoveries.

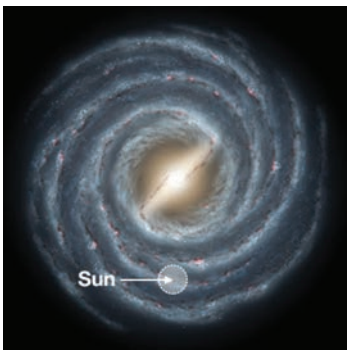


Figure 3 Location of our Sun in the Milky Way galaxy. The white circle indicates where most exoplanets have been found with current telescopes. [Credit: NASA/JPL-Caltech/T. Pyle]

None of the planets orbiting Kepler-90 are considered good candidates for life. Earth is the only planet we know of with life on it … so far. Scientists are searching the galaxy for planets similar to Earth and signs of life. As we see on Earth, life can adapt to conditions that human beings would consider very harsh (temperature, radiation, salinity, acidity, aridity, etc). So it may be possible that life started on other worlds and adapted to conditions quite alien to what we are used to.

The Kepler telescope has so far only scanned a small portion of the Milky Way up to around 4000 light years from the Sun. So many more solar-like systems may yet be discovered in the whole galaxy.

*References: • "Discovery of eight planets" at exoplanets.nasa.gov/ • NewScientist 23/30 Dec 2017*

## Race to discover element 119 has begun

With IUPAC's decision to accept four new elements in December 2016, all elements from hydrogen (element 1) up to oganneson (element 118) have been discovered, thus completing the periodic table to the end of period 7. The next two elements expected to be discovered are elements 119 and 120. They will belong to the alkaline metals and alkaline earth metals respectively – and will begin the new period 8 in the periodic table.

Through international collaboration, the quest to synthesise element 119 began in December 2017. The Riken team, led by Kosuke Morita in Japan, are bombarding a curium target with an accelerated vanadium ion beam. This team was previously successful in producing nihonium (element 113) by bombarding a bismuth target with zinc ions. In Dubna, Russia, another team will try to produce element 119 by bombarding berkelium with accelerated titanium ions.

The target metals being used (curium and berkelium) are being supplied by the Oak Ridge National Laboratory in Tennessee, USA. This is a good example of international collaboration in Science research.

New elements now are only made atom by atom. They are synthesised by firing a beam of highly accelerated ions at a heavy element target in the hope that the two will fuse to form a new even-heavier nucleus of a new element. The new element is highly radioactive and is identified by its decay products. The long time taken and the huge costs involved means there are only a few places in the world where such research can occur. Such experiments may only result in the production of single atoms of the new element that only last for a few seconds or less.

Historically, new elements have been discovered by their isolation in macroscopic amounts that were useful. The most successful discoverer of new elements, Sir Humphry Davy, is credited with discovering sodium, potassium, calcium, magnesium, strontium, boron and barium. He is also credited with establishing that chlorine and iodine were elements – even if he and his assistant, the now famous Michael Faraday, blew up a hotel room in Paris, where they had set up a make-shift lab to prove this.

*Reference: Journal of Royal Society of Chemistry: www.chemistryword.com*

## HSC statistics: Science entries in 2017 HSC

The total number of entries for HSC Science courses* in 2017 was 48,190 and the total number of HSC entries for the 2017 HSC was 77,300. So the Science entries were 62.3% of the total entries.

The number of HSC Science entries as a % of the total HSC entries from 1992–2017 is given in the bottom table below. This % has decreased significantly from a peak of 90.8% of the total candidature in 1992# to only 55.8% in 2002. Many attribute this as being due to the larger number of subjects that were made available for students. Since 2011, until now, the % of Science entries in the HSC has hovered around 60–62%.

| *Science subject* | *Total* | ♂ | ♀ |
|---|---|---|---|
| Biology | 6826 | 11,327 | 18,153 |
| Chemistry | 6008 | 4966 | 10,974 |
| Physics | 7378 | 2195 | 9573 |
| Earth & Environmental Science | 957 | 768 | 1725 |
| Senior Science | 3721 | 3340 | 7061 |
| Science Life Skills | 478 | 226 | 704 |
| TOTAL | 25,368 | 22,822 | 48,190 |

* These are the total number of entries in Science courses, and not the actual number of students who study a Science course, since a fair percentage actually study 2 courses in the same year, and some students since Pathways do 3 Science courses. The Science Life Skills students are part of the total Science entries.

\# The total number of entries prior to 1996 was based on the total English candidature. Since then, due to Pathways, the total figure each year is still based on English entries, but is slightly affected by acceleration students, Pathways students, etc.

§ The total number of students reflects the actual number of students who received a result for each science subject. It can differ from the figures given in the media, as their figures were the number of HSC entries for each subject as of 1 September 2017. There is usually a difference between these two sets of figures because some students have illness/misadventure/unexplained absences/answers for more than one option, and so do not sit for the examination.

**Entries for HSC Science courses 1992–2017 as a percentage of the total number of HSC entries#**

| Year | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 | '04 | '05 | '06 | '07 | '08 | '09 | '10 | '11 | '12 | '13 | '14 | '15 | '16 | '17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | 90.8 | 87.7 | 80.1 | 72.0 | 73.8 | 72.3 | 70.2 | 69.9 | 64.1 | 58.0 | 55.8 | 56.5 | 58.3 | 58.4 | 59.4 | 57.9 | 60.5 | 59.8 | 59.9 | 62.1 | 60.8 | 61.1 | 61.1 | 60.3 | 60.9 | 62.3 |

*These tables were prepared by Robert Garner using data from NESA, January 2018.*

Astronomy

# The Summer and Autumn skies make great viewing ... Robert Garner

Viewing in Summer has the advantage of being warmer. However, as winter approaches, the night skies become dark earlier, giving a longer viewing time.

For a good night's viewing, your students will need to know the compass directions (these are on most mobile phones) and use a star chart (see Box 1). Make sure when downloading a star chart that it is for the Southern Hemisphere. Optional extras are a small pair of binoculars and a torch covered with red cellophane to read and record their notes.

## The Planets – let the Moon be your guide

When looking for a planet, locating it is much easier if you let the Moon be your guide. Resources, such as *Astronomy 2018* include month by month sky maps for this purpose. Sydney Observatory also provides a monthly night sky guide and star map.

Venus (evening star) will return to the evening twilight by the end of February. It will be hard to see in the Sun's twilight, but by April the angular separation of Venus from the Sun will have increased and Venus will be seen as a brilliant object in the sky to the NW until mid October. Thereafter, Venus moves closer to the Sun and will disappear into the twilight. Venus will return in November as the 'morning star'.

This year is ideal for viewing Mars. By July, the red planet will be at its closest to Earth since 2003 when Mars was at its closest to Earth for around 60,000 years. Between now and July, Mars will be increasing in brightness and in its apparent size as Earth, on its inside orbit, catches up to the slower moving Mars.

The naked eye planets, Mars, Jupiter and Saturn, will be visible in the pre-dawn sky when the 2018 school year commences. They will be close to the Moon between 6–12 February. Jupiter will be above and close to the Moon on 10-11 March, while Mars and Saturn will be close together and not far above the Moon around 10–12 March.

At the end of March and beginning of April, Mars and Saturn will be close to one another in the eastern late night sky. On 7 April, Mars and Jupiter will again be close together, with the Moon to the left of Mars. Saturn will be above the Moon and between the open cluster, M25 to its left and the globular cluster M22 to its right. All will fit into the field of view of binoculars together at this time. You will need a tripod or another form of support to keep your binoculars steady.

## Stars and constellations

The summer constellations, *Orion* (the Hunter) and *Taurus* (the Bull), will still be high in the sky overhead each night and slightly to the north-west. Being in the southern hemisphere, *Orion* appears upside down to us. We see *Orion's* belt making the base of 'the saucepan' asterism. *Orion*'s sword, pointing into the air from the belt is the 'saucepan's handle'. Above the saucepan are *Orion*'s legs with the bright blue-white star Rigel at the foot. Below, the saucepan, at one of *Orion*'s shoulders is the red supergiant, Betelgeuse that can be clearly seen to be orange-red.

As you look to the north-west, *Orion* is above the constellation *Taurus*. *Taurus* includes the beautiful star cluster, The Pleiades, which is also known as The Seven Sisters, or as Subaru to the Japanese.

*Crux*, the Southern Cross, and its two Pointers are low to the south-east with the Magellanic Clouds above. *Crux* is lying on its side. *Crux* will be good viewing all through winter.

## Meteor showers

The alpha-Centaurids (in *Centaurus*) will be active from 18 January to 21 February, peaking around 8 February. However, the Moon may hamper seeing them, as a Last Quarter Moon falls right on the peak. The gamma-Normids (in *Norma*) are active between 25 February to 28 March, peaking around 14 March. While they have a low rate per hour, a New Moon on 9 March will make viewing them favourable.

The Lyrids should be visible between 14–30 April (peaking on 22 April) about one hour before sunrise, as this Northern Hemisphere shower is visible south of the equator.

Individual meteors during a shower seem to be coming from a common point in the sky, known as the radiant. The meteor shower is usually named after the constellation in which the radiant appears To see meteors, you should look generally northwards, after 1 am, get away from city lights and avoid a bright Moon. Remember, meteors tend to come in spurts, interspersed by quiet periods.

## Equinox

The autumn equinox occurs at 3:15 am (AEDT) on 21 March. This is when the Sun will be shining directly on Earth's equator and there will be nearly equal amounts of day and night throughout the world. However, the daytime will actually be about 9–10 minutes longer than the hours of darkness. Daylight and nighttime hours become equal about three days after the equinox. It is derived from Latin: *aequus* (= equal) and *nox* (= night).

## International Space Station (ISS)

The ISS orbits Earth once every 90 minutes at about 400 km altitude and a speed of about 28,000 km $h^{-1}$. Predictions for when the ISS can be observed are at: *www.heavens-above.com*

### Box 1: Sky Charts & Planispheres

- You can download free sky charts each month to explore the night sky from: *www.skymaps.com/downloads.html* Make sure that you scroll down to 'Southern Hemisphere Edition'.
- A planisphere (star wheel) helps to find stars and locate constellations. These are inexpensive and available from astronomy shops, or you can download one – make sure it is for the Southern Hemisphere. While the site itself is out-of-date, there is a planisphere (star wheel) to print and use at: *http:/members.ozemail.com.au/~starrylady/resources.html*

### MACQUARIE UNI ASTRONOMICAL OBSERVATORY & PLANETARIUM SESSIONS

The Macquarie University **Astronomical Observatory** (access via Gymnasium Rd) is open to the public every Monday and Friday night (Jan–Nov inclusive). It runs from 8–9.30 pm (in AEDT) or 7–8.30 pm the rest of the year. Bookings are essential and must be made online. If doubtful weather, you will be sent an email and get a refund.

There are also **planetarium sessions** on the first Thursday of each month (Mar–Nov, not June) from 6:30–7:30 pm at Macquarie Uni. Tickets must be booked online. These sessions are not weather dependent.

For details & bookings, go to: *www.physics.mq.edu.au/astronomy* then in 'Engage with us', look for '*Visit the Observatory*' or '*Visit the planetarium*'.

### CONGRATULATIONS

*SciTalk No. 2–2017* 'Astronomy Giveaway' winners, Megan Bromley (Riverina Anglican College) & Sandra Megay (St Peters Anglican College), each won a copy of:

**ASTRONOMY 2018**

**A PRACTICAL GUIDE TO THE NIGHT SKY**

by Glenn Dawes, Peter Northfield, Ken Wallace

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All prices are current for 2018 and are not inclusive of GST (10% GST will be added to invoice).

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**TO ENTER:** Send your answer to the Quiz Question, your name, school & school address by email to *cathie@odlumgarner.com.au* or on an envelope to: Competition Corner, PO Box 442 Freshwater 2096 – **by 13 April 2018**

**QUIZ QUESTION:**
To what group of organisms do archaea and bacteria belong?

*SciTalk 2/17 answer: Radioisotope*

***SciTalk 2/17* winner:** Mark Wilton, Charlton Christian College, won *Chemistry 2001-2016 Past HSC Papers with Worked Solutions* (rrp $39.95), published & donated by Odlum & Garner.



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**WINNER:** Thomas Herringson, Condell Park Christian School, won the Luna Park Sydney family pass from Beyond the Thrills for *SciTalk No. 2–2017.*



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*SciTalk* is a newsletter for secondary Science educators. Now in its 24th year, *SciTalk* has been produced by Odlum & Garner for Science teachers since 1995. It is sent FREE-of- charge to all secondary Science faculties in schools and TAFEs throughout NSW and the ACT.

*SciTalk* aims to provide Science teachers with up-to-date information, important dates, the latest products available, plus 'what's on' in various excursion venues, and more.

Please pass *SciTalk* on to all the Science teachers at your school, so they can benefit from it .

Contributions, advertising and inserts are welcome.

Copies of *SciTalk* are also available at:

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## CONTRIBUTIONS

*SciTalk* is now a bi-annual newsletter and due into schools in March and mid-year. All contributions should be directed to the Editor (see below).

**CLOSING DATES**

- *SciTalk* No. 2 – August 2018 ... closes 6 July 2018
- *SciTalk* No. 1 – March 2019 ... closes 20 Dec 2018

## ADVERTISING & INSERTS

All enquiries to the *SciTalk* Editor:

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