

# SciTalk

ISSN 1323-7667

Number 3 – July 2016

## Limited time to have your say!

### Draft Stage 6 syllabuses now available for consultation

Teachers only have until Wednesday 31 August 2016 to provide feedback to BOSTES on the draft Stage 6 (11-12) syllabuses for the various science subjects – Biology, Chemistry, Physics, Earth & Environmental Science and Investigative Science. The draft Stage 6 (11-12) syllabuses, online surveys and a registration facility for consultation meetings are available at: [www.boardofstudies.nsw.edu.au](http://www.boardofstudies.nsw.edu.au) in the 'Syllabuses' section.

The draft syllabuses have been designed to provide opportunities for students to engage in deeper learning in each course. BOSTES seeks your feedback on the draft syllabuses through face-to-face meetings, online surveys and written submissions.

The consultation period is only brief and concludes on 31 August 2016. Feedback received from consultations will be used to guide the development of the final syllabus documents. Hence it is important for teachers to have their say now.

The consultation meetings are free and will be held at various locations across NSW from 4 pm to 6 pm. They will provide an opportunity to hear from the subject Board Inspector about the draft syllabuses, discuss ideas with teachers from other schools, and provide group and individual feedback to BOSTES. You can pre-register your attendance at one of the consultation meetings on the BOSTES website. These meetings will contribute to 2 hours of BOSTES approved accreditation.

The new syllabuses will be released in 2017 to allow time for teachers to become familiar with the new content, which will be first taught to Year 11 students in 2018 and to Year 12 students in 2019.

A Year 12 Science Extension syllabus is also planned to increase opportunities for students to build STEM skills and knowledge. It will be for Year 12 from 2019. The draft Science Extension syllabus will be developed and available for consultation later in 2016.

The HSC reforms are the first update to the HSC in 17 years. BOSTES hopes that the implementation of these reforms will create an HSC that motivates and challenges students to do their best. The HSC reforms include: • establishing a minimum literacy and numeracy standard from 2020, • introducing rigorous guidelines for effective school-based assessment that focuses on the application of knowledge and skills, and reduces student stress by capping the number of tasks, • updated HSC exam questions to assess depth of knowledge and application of skills.

## ★ 2016 editions Past HSC Questions & Worked Solutions ... see p7 ★

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### ★★ ATTENTION ★★

After you have read this, please write/tick your name below and pass it on.

- 1. ....
- 2. ....
- 3. ....
- 4. ....
- 5. ....

Please return to file or noticeboard.

### PRIZES TO WIN!

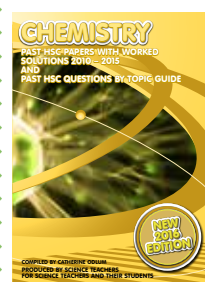
See pages 1, 9 & 12  
Post in your entries now  
(or send your details by email, if you prefer!)

Past issues of SciTalk are available at  
[www.odlumgarner.com](http://www.odlumgarner.com)

## Book Giveaway

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**2010–2015 Past HSC Papers**  
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(rrp \$39.95) - see p7  
... published by  
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A *Past HSC Questions by Topic Guide* for ALL papers is included, so students can revise topic by topic or use actual exam papers. It contains complete copies of ALL exams with ALL questions, diagrams, etc from 2010-2015, plus worked answers that are an appropriate length and would score full marks, a guide on *How to Achieve Success in the HSC*, and more. For more details about the Biology/Chemistry/Physics/Earth & Environmental Science books in this series, go to: [www.odlumgarner.com](http://www.odlumgarner.com)

TO WIN: Send your name, school & school address to Book Giveaway, PO Box 442, Freshwater 2096 (or by email to [cathie@odlumgarner.com](mailto:cathie@odlumgarner.com)) – by 23 Sept 2016.

★★★

Winner for *SciTalk* 2/16

Merlina Reid, OLMC Parramatta, won *Senior Science Past HSC Papers & Worked Solutions 2001-2015* (rrp \$39.95), published by Odlum & Garner.

# Diary Dates



## Update on BOSTES matters

Teachers should regularly check the BOSTES website [www.boardofstudies.nsw.edu.au](http://www.boardofstudies.nsw.edu.au) to ensure they have the latest information – on syllabuses, past exam papers, news, Official Notices, statistics archive and more.

Make sure you have updated yourself on the following BOSTES matters:

- *Consultation now open for Stage 6 (11-12) Syllabuses for Science* [20-7-16]  
See page 1 of this *SciTalk* 3-16.  
Note: The consultation period concludes on 31 August 2016.

- *New Periodic Table for HSC* [19-5-16]  
The Periodic Table for use in HSC exams has been updated to include elements 114 (Flerovium) and 116 (Livermorium), plus putting in the temporary systematic element symbols (Uut, Uup, Uus, Uuo) for elements 113, 115, 117 and 118.

[Note: There have been no changes to the Stage 6 Chemistry and Physics data sheets.]

- *Stage 5 & Preliminary course student work samples to be retained* [BOS 16/16]

- *Minor edits to Science Performance Band Descriptors* [BOS 20/16]  
Stage 6 Biology and Stage 6 Earth & Environmental Science have revised Science Performance Band Descriptors from 2016 HSC – see BOSTES website in ‘Syllabuses’.

- *HSC 2016 timetable*  
This is available on BOSTES website.

- *Personalised exam papers* [BOS 24/16]  
For 2016 HSC, Senior Science will have personalised question/answer booklets/or writing booklets for Sections 1 & II.

You can also log in to have the weekly BOSTES Bulletin emailed to you.

### BOSTES enquiries

Ph: 9367 8111, fax: 9367 8484  
[www.boardofstudies.nsw.edu.au](http://www.boardofstudies.nsw.edu.au)

Science contact: Inspector Science, K-12

## 2016 International Year of Pulses: <http://iyp2016.org>

Tour dates & towns for Shell Questacon Science Circus 2016:  
[www.questacon.edu.au/outreach/programs/science-circus](http://www.questacon.edu.au/outreach/programs/science-circus)

Nyholm Lecture series 2016: [www.raci.org.au/branches/nsw-branch/nyholm-youth-lecture-series](http://www.raci.org.au/branches/nsw-branch/nyholm-youth-lecture-series)

### AUGUST 2016

- 3 Chemistry Olympiad Exam. Close date: 20/7/16. Ph: 6201 2552, [www.asi.edu.au](http://www.asi.edu.au)
- 5 Earth Science Olympiad Exam. Close date: 20/7/16. Ph: 6201 2552, [www.asi.edu.au](http://www.asi.edu.au).
- 5 Jeans for Genes Day. [www.jeansforgenes.org.au/](http://www.jeansforgenes.org.au/)
- 8 Biology Olympiad Exam. Close date: 20/7/16. Ph: 6201 2552, [www.asi.edu.au](http://www.asi.edu.au)
- 10 Physics Olympiad Exam. Close date: 20/7/16. Ph: 6201 2552, [www.asi.edu.au](http://www.asi.edu.au)
- 12, 15, 19 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105  
– come on any of these dates to celebrate National Science Week
- 13–21 National Science Week. Theme: Drones, droids & robots. [www.scienceweek.net.au/schools/](http://www.scienceweek.net.au/schools/)

### SEPTEMBER 2016

- 3–11 National Seaweeek 2016. [www.mesa.edu.au/seaweeek.asp](http://www.mesa.edu.au/seaweeek.asp) & [www.ausmepa.org.au](http://www.ausmepa.org.au)
- 12, 16 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, [www.odlumgarner.com](http://www.odlumgarner.com)
- 23 Spring equinox (12:21 am AEST)

### OCTOBER 2016

- 11–17 Earth Science Week. [www.earthsciweek.org](http://www.earthsciweek.org)
- 13 HSC exam period commences ... ends 4 November
- 14, 17, 21 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, [www.odlumgarner.com](http://www.odlumgarner.com)
- 21 Biology Teachers’ Professional Development day. Enquiries: Human Disease Museum, UNSW
- 22 National Schools Titration Competition. [www.raci.org.au](http://www.raci.org.au)
- 24, 28, 31 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, [www.odlumgarner.com](http://www.odlumgarner.com)

### NOVEMBER 2016

- 11, 14, 18 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, [www.odlumgarner.com](http://www.odlumgarner.com)
- 21, 25, 28 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, [www.odlumgarner.com](http://www.odlumgarner.com)

### DECEMBER 2016

- 1–16 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, [www.odlumgarner.com](http://www.odlumgarner.com)
- 21 Summer solstice (9:44 pm AEDT)

**JANUARY 2017** National Youth Science Forum. Forms to local Rotary club by 31/5/16, interviews from July. Only for Yr 11 in 2016. Enquiries: 6125 2777, email: [nsss@anu.au](mailto:nsss@anu.au), [www.nysf.edu.au/](http://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.*

## 2016 Science HSC Examination Dates

- 17 Oct Senior Science: 1.55 pm–5 pm
- 18 Oct Earth & Environmental Science: 1.55 pm–5 pm
- 20 Oct Biology: 9.25 am–12.30 pm
- 31 Oct Physics: 9.25 am–12.30 pm
- 3 Nov Chemistry: 9.25 am–12.30 pm

**NOTE:** When you purchase the Odlum & Garner Past HSC Questions & Worked Solutions books for Biology, Chemistry and Physics, you are helping to support the production of the Past HSC books for Earth & Environmental Science and Senior Science.

\*\*\*\*\*

Thank you to all the teachers who support these projects.

Life is like  
riding a bicycle.  
To keep your balance,  
you must keep moving.

... Albert Einstein  
(1879-1955)



## High altitude ice – an invisible killer

Air crash investigators have discovered a possible cause for a number of previously unexplained air crashes. US investigators have identified more than 30 incidents where planes flying at high altitude (above 10,000 metres) had sudden engine failure.

Details common to several of these incidents was ice blocking an air speed sensor called a pitot tube, as well as other sensor malfunctions. The pilots also reported heavy rain on the windscreens, even though the plane's radar indicated totally clear conditions.

All this seemed quite strange – as generally accepted meteorology was that liquid water could not exist at such cold temperatures and icing up of aircraft could not occur above 6700 metres altitude. However, studies involving NASA have discovered that tiny, electrostatically charged, 40 µm ice crystals can form at these altitudes. They are invisible to normal weather radar. Their electric charge interferes with sensors on the plane. These small ice particles accumulate in contact with warmer parts of the plane, such as the engines and windscreen. They then refreeze to form lumps of ice that can get into the jet engine, damaging it or causing it to stall.

Weather radar detects weather conditions likely to cause normal icing. Normal icing up of planes is prevented either by the pilot changing course or by treating the icing with anti-icing sprays from outlets on the wings to get rid of it whilst mid-air.

However, crystal icing is so far undetectable and unpredictable until it occurs. In some incidents, pilots were able to restart the engines after the planes had dropped several thousand metres in altitude, thus allowing the accumulated ice to melt, and in a couple of cases pilots were able to make 'dead-stick landings' (forced landings) safely without any engine power\*. However, in some cases planes crashed with considerable loss of life.

\* It is interesting to note that a Boeing 747-200 is able to glide up to about 150 km after an engine failure at 10,000 metres and land unpowered – this only helps of course if there is somewhere for it to land safely!

References: • NewScientist 2 July 2016 • [www.flightsafetyaustralia.com](http://www.flightsafetyaustralia.com)



Figure 1 A black box flight recorder is normally located near an aircraft's tail, as this area generally suffers the least damage in an accident.

[Credit: Australian Transport Safety Bureau; Sabung.hamster, Wikimedia]

### Box 1 Black box flight recorder

A flight recorder helps investigators to identify the factors behind an accident. They usually have a Cockpit Voice Recorder (CVR), a Flight Data Recorder (FDR), plus a battery-powered Underwater Location Beacon to aid underwater recovery.

Popularly known as 'black boxes', these flight recorders are painted orange to help in their recovery after an accident.

A CVR retains the last 2 hours of audio from the cockpit, e.g. crew conversation, radio transmissions, aural alarms, control movements, switch activations, engine noise and airflow noise. The FDR records flight parameters, such as altitude, airspeed, magnetic heading, acceleration, radio transmission times, etc.

## SHIPS, CLOCKS & STARS: THE QUEST FOR LONGITUDE



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## Milky Way disappears

Light pollution from human-made light has now reached the stage that 30% of the world's population can no longer see the dim glow of the Milky Way stretching across the sky. Across Europe and North America, this situation is even worse with 60% and 80% of their populations respectively living in a perpetual man-made twilight where the sky never becomes really dark.

Here, in Australia, our cities are the same. Few of us are able to see the fifth brightest star of *Crux* in the sky and only know it from our flag. This situation is making it almost impossible for astronomers – who need dark night skies without the glare of city lights.

Reference: NewScientist 18 June 2016

## Geophysics helps archaeologists

Archaeologists today are able to use the tools of geophysicists to investigate archaeological sites. They can make discoveries without having to excavate, which in the past, involved days of slow and painstaking work with a spade, shovel and toothbrush. The new methods are much quicker and can be used without disturbing the site at all.

Non-invasive techniques, such as remote-sensing, ground-penetrating radar (GPR) and magnetometers, enable archaeologists to 'see' through thick layers of earth to structures buried metres below. Then with the aid of 3D computer modelling, archaeologists can reconstruct subterranean areas, leaving what is buried intact. The resolution of GPR and other remote-sensing instruments enables the building materials used to be determined and even inscriptions on buried stone in buildings to be read.

For example, archaeologists working at Carnuntum in Austria have been able to discover many structures from a town that existed between 6–450 AD, e.g. the gladiator school and arena, large public buildings like temples, a forum and thermal baths, graves, armaments and other relics. They have also found that the town had paved roads and an extensive sewage system. Fortunately the area has not been built over, and so the new techniques have been ideal for exploring it.



[Credit: Reiner Riedler / Anzenberger Agency]

Figure 2 A motorised GPR array going over the ground above an amphitheatre

Reference: www.smithsonianmag.com/



## Senior Biology Teachers' Professional Development Day

on Friday 21 October 2016

The program will consist of lectures and workshops to update and expand your knowledge and skills in key areas of the Biology syllabus.



The 2016 program will include expert lectures from UNSW researchers and workshops on topics such as: enhancing student engagement, sexual selection, gene therapy, comparative embryology, neuroplasticity and de-extincting the Tasmanian tiger.

Registration: 8 am for a 9 am start, finishes 4 pm

Book early to avoid disappointment

Workshop choice allocated on order of registration.

Cost: \$160 (includes morning tea, lunch, sundowner & GST) ... parking is \$20.

This PD program is BOSTES accredited for 6 hours.

BOOKINGS E: [diseasemuseum@unsw.edu.au](mailto:diseasemuseum@unsw.edu.au) T: (02) 9385 1522

Registration form at: [www.diseasemuseum.unsw.edu.au](http://www.diseasemuseum.unsw.edu.au)

## Outdoor light – key to reducing myopia

Myopia, also known as short-sightedness, is becoming pandemic around the world. In China, 90% of 17–19 year olds now suffer from myopia. This is a huge increase from an estimated 10% in 1950.

For many years, the scientific consensus was that myopia was largely due to genes. It was also thought that the problem arose from too much time being spent reading or studying or too much TV and computer use.

It is now known that only about 30% of the risk of myopia is genes and that children who spend more than 2 hours a day using screens are 2–3 times more likely to become short-sighted than normal. A study in Taiwan (2013) showed that getting school children to spend class recess outdoors was effective in preventing myopia's onset and development.

In 2015, Australian optometrists released the results of an 18 month study into light and myopia. They found that greater daily light exposure was associated with less axial eye growth over 18 months, supporting the role of light exposure in the documented association between time outdoors and childhood myopia, and supporting the notion that there may be a threshold of daily light exposure required in childhood to slow axial eye growth and in turn, reduce the development and progression of myopia.

Optometrists can now advise parents that children need to spend more than one hour and preferably at least two hours a day outside to help prevent myopia from developing and progressing.

References: • National Geographic Feb 2016  
• [bmcophthalmol.biomedcentral.com](http://bmcophthalmol.biomedcentral.com) 9-7-15  
• Nature 519, 276–278 (19 March 2015)  
• [www.optometry.org.au](http://www.optometry.org.au) (2016)

## Mosquitoes only target certain people

Your blood type, metabolism, exercise, shirt color and even drinking beer can make you a target for mosquitoes. Research has shown that around 20% of the population is consistently bitten by mosquitoes more often than the remaining 80%.

One genetic factor affecting this is blood type. When harvesting their meal of blood, mosquitoes prefer group O blood over group A. They land on blood group O people twice as often as on people with group A. Blood group B people lie inbetween. Another genetic factor is due to secretions that signal a person's blood group. Around 85% of people produce such secretions, while the remaining 15% do not. People who are secretors are more often bitten than those who are not.

Mosquitoes detect exhaled CO<sub>2</sub>. So people exhaling larger amounts of CO<sub>2</sub> are more likely to be bitten. So the obese are bitten more often than the svelte, and adults in preference to children. Also, pregnant women, who are respiring for their baby as well as themselves, are producing more CO<sub>2</sub> and so are more likely to be bitten.



[Credit: James Gathany/CDC (US), Wikipedia]

Figure 3 Female *Aedes albopictus* mosquito obtaining blood from a human host.

Reference: www.smithsonianmag.com/science-nature/

## Urine-based ink

Restoration experts in Italy have been working on the 1500 year old remains of a text, the Rossano Gospels, also known as the *Codex purpureus Rossanensis*. This is one of the oldest surviving illuminated manuscripts of the New Testament, thought to have been handwritten in Syria around the 6th century. The codex that remains contains the whole gospel of Matthew and most of Mark.

The manuscript became famous due to the mystery of the red-purple dye on its pages (*purpureus* in Latin). Previously, it was thought that the dye was Tyrian purple, derived from sea snails (*Murex*).

As with many other modern restoration efforts, restorers relied on non-invasive techniques to study the composition of the silver and gold inks that were used in writing the Codex, as well as the red-purple dye used to colour the pages. They compared the composition of the inks and dyes used in the Codex with dyes recreated from recipes found in a Greek papyrus dating from 300 AD.

Their use of X-ray analysis showed that the red-purple dye was actually made using



Figure 4 Pages from the *Codex Purpureus Rossanensis*, which is famous for its red-purple colour made from fermented urine.

[Credit: Michele Abastante, Wikimedia]

orcein, a dye extracted from lichen (*Roccella tinctoria*), as well as sodium carbonate and fermented urine. The use of urine to make dye was widespread from before Roman times. This is because urine was the only available source of ammonia to help stabilise the chemicals used to dye cloth.

References: • [www.livescience.com](http://www.livescience.com)  
• [www.sciencealert.com](http://www.sciencealert.com)

## New parasitic bacteria

Scientists from Washington University's School of Dentistry have discovered a new form of parasitic bacteria in human saliva. Whilst viewing a previously known species, *Actinomyces odontolyticus*, under the microscope, they found that the surface of this large bacterium was covered with much smaller parasitic bacteria. This new form of bacteria has only 700 genes and is the first strain ever discovered that is fully dependent on its host for nutrients. It also appears to make its host more harmful to humans.

The populations of *A. odontolyticus* are normally kept in check by macrophages. However, the parasite allows its host to evade macrophages. Its presence appears to be particularly linked to gum disease and to people with cystic fibrosis. The parasite also makes the host bacteria become resistant to the antibiotic streptomycin.

References: • NewScientist 2 July 2016  
• [www.sbs.com.au/topics/science](http://www.sbs.com.au/topics/science)

## Australian bionic successes

A prominent Australian example of medical bionics is the cochlear implant, or 'bionic ear'. Developed by Professor Graeme Clark in 1982, this involves the use of a multi-channel cochlear implant. Nearly 500,000 people worldwide now use these implants.

A fully implantable 'Phoenix99 bionic eye' has been successfully demonstrated recently by Australian researchers at the UNSW, Professors Nigel Lovell and Gregg Suaning, who have been working on this since 1997. Their bionic vision system consists of a digital camera, attached to a pair of glasses, which transmits high-frequency radio signals to a microchip implanted in the retina. Electrodes on the implanted chip convert these signals into electrical impulses to stimulate cells in the retina that connect to the optic nerve. These impulses are then passed along the optic nerve to the vision processing centres of the brain, where they are decoded into vision.

The bionic eye requires further research and development before it is ready for trials and manufacture. However, it has the potential to transform the lives of millions of people with degenerative retinal conditions – e.g. up to two million people have retinitis pigmentosa and up to 196 million have age-related macular degeneration.

Reference: [www.engineering.unsw.edu.au](http://www.engineering.unsw.edu.au)

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Well done is better  
than well said.

... Benjamin Franklin  
(1706-1790)

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<b>Senior Science</b>	2001–2015 Senior Science Past HSC Papers with Worked Solutions	978 1 921741 47 0	\$39.95	
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## Marten closes LHC at CERN

The Large Hadron Collider (LHC) at CERN, the world's largest and most powerful particle accelerator, was disabled for a week in April this year after a beech marten (*Martes foina*) dug under a fence and chewed through wiring connected to a high voltage (66 kV) transformer. This caused a short circuit that damaged transformer connections, resulting in a power cut to part of the LHC. The LHC bounces high-energy particle beams into each other at almost the speed of light to help scientists understand some of physics' 'biggest questions'.

Beech martens are native to the area near the LHC at CERN, as well as to much of Europe and Central Asia. They are long and



Figure 5 Beech Marten [Credit: M.zlinko, Wikimedia]



Figure 6 The LHC tunnel, where beams of particles pass through central pipes before colliding with each other. [Credit: CERN]

slender, with a long, bushy tail and grow to about 40–50 cm long, with a weight of up to two kilograms. They are omnivores in the Mustelidae family that also includes badgers, otters and weasels.

The LHC is in a 27 km, near-circular underground tunnel on the French-Swiss border, close to Geneva. Similar wild encounters have occurred at CERN before, and are considered part of life in running the accelerator, as with any industrial installation. Another time, a passing bird dropped a baguette on a substation above the LHC, causing a power failure.

Beech martens normally prefer open deciduous forest and rock out-

croppings in mountainous habitats. They can be found at elevations up to 4000 metres during summer months. They prefer open landscapes, being less dependent on forested habitats than other *Martes* species. *Martes foina* is frequently found living near human habitation, where they may set up their den in one of the buildings. This may account for the presence of one near the high-voltage electrical equipment at CERN.

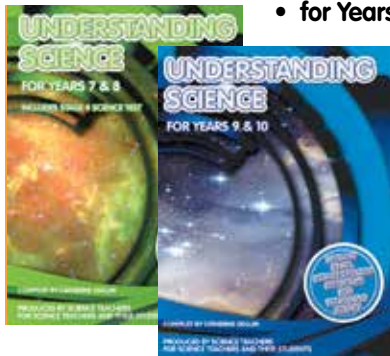
Fortunately beech martens are not endangered, as this one did not survive the encounter. This is a cautionary tale to the rest of us, to not touch complex electrical equipment if we don't know what we're doing.

References: • [www.theguardian.com/science/](http://www.theguardian.com/science/)  
• CERN News Bulletin 30/4/16

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## Record-breaking migration by Arctic Tern

Digital tracking of creatures from tiny birds to whales is offering up new data on the epic trips some species make.

Renowned for its extremely long migrations, a tiny 100 gram Arctic Tern was recorded in 2015 as flying a round trip totalling 96,000 km from its breeding grounds in the Farne Islands, off the coast of Northumberland (UK) to Antarctica and back. This is the longest ever recorded migration.

Researchers at Newcastle University (UK) electronically tagged a leg on 29 of these

birds with ultra-light geolocators, weighing only 0.7 g. Of the 29, 20 birds have returned. These birds take a circuitous route on their migration to take advantage of favourable winds and rich ocean feeding grounds where they rest over and replenish their energy.

Since Arctic Terns often live for over 30 years and make such migrations annually, they are in fact flying a distance of over three times the distance to the Moon and back over their lifetime.

*References:*

- NewScientist 11 June 2016
- Greenland Institute of Natural Resources



Figure 7 Left: Arctic Tern with a geolocator on its leg. Right: A geolocator, wrapped in a waterproof cover, attached to the leg of an Arctic Tern.

[Credit: US Fish & Wildlife Service]

## New human species

Archaeologists have discovered hominin bones in two caves in Southern China at Longlin and Maludong that resemble archaic humans. They were found with other human and animal bones and dated to about 10,500 years. The hominin bones are painted in red ochre, show butchering marks and have been broken in a particular way to extract bone marrow. The shape of the femur bone suggests an adult weighed about 50 kg and the muscle attachment points indicate that they walked differently to modern humans.

This suggests that, at the time agriculture was being introduced in China, modern humans co-existed with an archaic form of human and mated with them, as well as preying on them and using their bones as tools.

So far, the search for DNA in these remains has been unsuccessful, as any DNA present has been destroyed by burning or exposure to the humid climate. If proved correct, this evidence indicates more recent archaic humans were on Earth after the Denisovans, the Neanderthals and the Indonesian 'Hobbits' all became extinct.

Reference: NewScientist 2 Jan 2016

## Contraception for kangaroos

Australia has well over 40 million kangaroos and in some areas their numbers are locally excessive, resulting in many damaging collisions with cars and pollution of water supplies. In recent years, over 5 million kangaroos have been shot each year to control numbers. Some of these kangaroos are used to supply meat and pet food. However, many are just left to rot. There is increasing opposition to this slaughter.

An alternative method of population control has been trialled by Melbourne

University scientists in the Western Plains district of Victoria. Levonorgestral implants, usually used in women, have been implanted in 75% of the female kangaroos inhabiting a 200 hectare area. A follow-up to this study found that only a single kangaroo of all those that had received the implant became pregnant and the fertility of the whole population was reduced to about 30% of the previous rate. The population is currently stable, so culling is no longer needed. While the cost is \$250 per implanted animal, the cost of annual culls is also high.



Figure 8 Red kangaroo [Credit: Drs, Wikipedia]

Reference: NewScientist 25 June 2016

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**WINNER:** Melani Winton-Holmes, Airds High won a Luna Park Sydney family pass for *SciTalk* No. 2–2016.



## Wintertime is here and great for astronomy

... Robert Garner

During Term 3 this year, the evening and night sky should be ideal for viewing the five 'naked eye' planets.

### The Planets

Mercury and Venus will be low in the western evening twilight in July. By August, all five 'naked eye' planets will be easily seen in the night sky. Mercury, Venus (the 'evening star') and Jupiter will all be close to one another, low in the western sky in the early evening. While Mars and Saturn will be high in the sky and slightly to the west of north, in the first part of each night.

On 27 and 28 August, Venus and Jupiter, the two brightest celestial objects after the Sun and the Moon, will be within 1° of one another to the West – they will be shining like approaching car headlights, although of different brightness. Venus is the brighter of the two with a magnitude of  $-3.8$ , while Jupiter has a magnitude of  $-1.7$ . Mercury is only about 4° away to the left and a little higher in the sky. Mercury has a magnitude close to 0, so it will be dimmer.

### Constellations

The Milky Way stretches from north to south across the sky early in the night. If you are away from city lights, this can provide a magnificent panorama with the clear, low humidity of the air at this time of the year.

The dominant winter constellations to look out for are *Scorpius* (the scorpion), with its hook-shaped tail and bright, red heart Antares, and *Sagittarius* (the archer) whose bright stars form the teapot asterism. They will be overhead each night.

*Crux*, or the Southern Cross, will be high in the south-west. On a clear, moonless night it should be possible to see the Coalsack nebula, a dark region that lies between the two brightest stars of the Southern Cross, known as  $\alpha$  Crucis and  $\beta$  Crucis.

The Jewel Box, an open cluster in *Crux*, should be easily visible to the naked eye as a hazy object – it will be about 1.0° southeast of  $\beta$  Crucis and northeast of the Coalsack. However, with binoculars, its true nature will be seen as a group of many stars that show distinctly different colours.

Above the Southern Cross is  $\omega$  Centauri, the largest and brightest globular cluster in the sky. To the naked eye, this appears as a faint fuzzy patch – but it actually is a cluster of about a million stars. It is another good object for you to aim your binoculars towards.

### Did you know?

*Crux* used to be visible in the Northern Hemisphere. In ancient Greece, it formed the hind legs of the constellation *Centaurus*. But it hasn't been seen in Athens for over 1000 years. The position of *Crux* in the sky hasn't changed, but the Earth's axis has!

### Meteor showers

From around 17 July until 24 August, the Perseid meteor shower will be active as Earth passes through the long trail of dust and debris left by Comet Swift-Tuttle. It is predicted to be this year's best meteor shower, with a much higher rate than usual. The peak will be around 12/13 August, so the Moon should not be a problem as it is not a Full Moon until 18 August.

As they enter the Earth's atmosphere and streak across the sky at about 59 km per second, the meteors will appear to originate from the constellation *Perseus*. Remember, the best time to view meteors is usually after 1 am, after the Moon has set and in a dark area, preferably away from city lights. You should prepare to sit outside for a few hours. It takes about 30 minutes for your eyes to adjust to the dark, and the longer you wait outside, the more you'll see.

### Spring equinox

The spring equinox for the Southern Hemisphere of the Earth occurs at 12:21 am on 23 September. At this time, the Sun will appear to cross the equator from north to south. On this day, people living close to the equator will see the Sun rise in an exactly easterly direction and will see the Sun set in an exact westerly direction.

### A second 'moon' for Earth

NASA recently announced, on 27 April 2016, that a new 'moon' orbiting Earth had been discovered by the Pan-STARRS 1 asteroid survey telescope on Mt Haleakala, Hawaii. At an altitude of 3055 m, this optical telescope is at the highest point on the island of Maui in Hawaii and well above most of the atmosphere.

As it is about 14 million kilometres from Earth, this second 'moon' has been deemed too distant to be considered a true satellite of Earth – so this 'quasi-satellite' is being referred to as an asteroid called *2016 HO3*, rather than a 'moon'. As it orbits the Sun, this asteroid is in a stable, highly elliptical orbit around Earth that ranges from a distance 38× that of the Moon at its closest, out to a distance 100× that of the Moon at its greatest distance from Earth. It has an elongated, irregular shape – its exact size has not yet been determined, but its diameter is thought to be between 40–100 m.

Astrophysical calculations indicate that this newly discovered satellite has been orbiting Earth for a long time and will not escape Earth's gravity for at least many centuries to come.

But don't waste your time looking for this asteroid – it has a magnitude ranging from 23–25, which is so faint that only the most powerful detectors on Earth will ever see it.

### Using a Sky Chart / Planisphere

Remember, viewing the night skies is much simpler if you have a Sky Chart or Planisphere. See Box 1 to easily obtain one of these.

#### Box 1: Sky Charts & Planispheres

- You can download free sky charts each month to explore the night sky from: [www.skymaps.com/downloads.html](http://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>

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There are also **planetarium sessions** on the first Thursday of each month (Mar to 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](http://www.physics.mq.edu.au/astronomy) then look for 'Astronomical Observatory' or 'planetarium' in 'For the public'.

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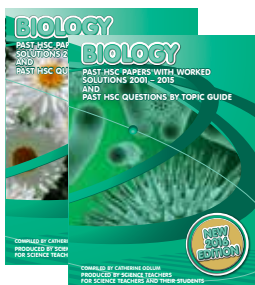
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