

SciTalk

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Memory and revision 'pays off'


The human brain is incredibly adaptive. Our mental capacity is astonishingly large and our ability to process widely varied information and complex new experiences with relative ease can often be surprising. The brain's ability to act and react in ever-changing ways is known, in the scientific community, as 'neuroplasticity'. You can read more on this on page 5 of this *SciTalk*. Neuroplasticity is what allows the brain's estimated 100 billion nerve cells (i.e. neurons or gray matter) to constantly lay down new pathways and to rearrange existing ones throughout life, thereby aiding the processes of learning and memory. Without the ability to make such functional changes, our brains would not be able to memorise a new fact or master a new skill, form a new memory or adjust to a new environment.

When students are learning their work, they should understand the processes involved so they study more effectively. In response to new information, neuroplasticity allows either an alteration to the structure of already-existing connections between neurons, or forms brand-new connections between neurons. When first exposed to something new, that information enters our short-term memory. The electrochemical impulses of short-term memory stimulate one neuron, which then stimulates another. The key to making information last and go into long-term memory however, occurs when repeated revision occurs, which leads to lasting structural changes that hard-wire the new information into the neural pathways of our brains. Further repetition of the same information will lead to more modifications in the connections that house it, or an increase in the number of connections that can access it – hence each revision session results in a shorter learning time and a longer retention time. So revision does 'pay off'! The role of sleep in memory should not be underestimated either – see page 4 of this *SciTalk*. □

Some resources for the 2010 International Year of Biodiversity

To help Science teachers focus their students attention on environmental issues this year, *SciTalk's* website (at www.odlumgarner.com) has many different internet addresses for online resources, lessons and activities to use when teaching about biodiversity.

You can just copy and paste these internet addresses to go straight to the resources. □



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★ NEW: 2001-2009 Past HSC Questions & Worked Solutions ... see p7 ★

★★ 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, 11 & 12 ★★
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(ALL IN THE ONE ENVELOPE if you prefer!)

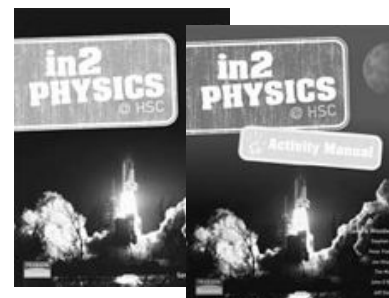
This *SciTalk* & past issues are available at
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★★★
Winner for *SciTalk* 2/10

Congratulations to Tom Callan, Delany College, who won *Science Tests for the School Certificate* (rrp \$32.95) published by Odlum & Garner.

Diary Dates 2010



Update on BOS matters

Regularly check the BOS website to ensure you have the latest data – for syllabuses, past exam papers, news, Official Notices, Board Bulletins, the statistics archive & more.

Official Notices are now online ONLY

Official Notices will be effective from the date they appear on the BOS website.

Curriculum to use in 2011 (BOS 18/10)

All NSW schools are to continue to use the existing NSW K–12 syllabuses for 2011.

HSC Timetable now available on website

The 2010 HSC will run from 14 October to 10 November ... see website for timetable.

BOS enquiries

Ph: (02) 9367 8111, fax: (02) 9367 8484
 Website: www.boardofstudies.nsw.edu.au/
 BOS contacts for Science:
 • Inspector Science, K–12 & Senior
 • Assessment Officer – Science

.....
 • “Courage is resistance
 • to fear, mastery of fear,
 • not absence of fear.”
 •
 • ... Mark Twain
 •
 •.....

International Year of Biodiversity

AUGUST 2010

- 2–15 Australian Science Festival, ACT. For school Activities visit: www.sciencefestival.com.au
- 4–21 Shell Questacon Science Circus ... in Orange, Bathurst, Dubbo, Coonabarabran, Parkes: www.questacon.edu.au/html/on_the_road.html
- 6 Jeans for Genes Day. www.jeansforgenes.org.au/
- 9, 13, 16, 20 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 14–22 National Science Week. *Australian Biodiversity*.
- 13, 16, 20 National Science Week events: Physics is Fun at Luna Park. www.odlumgarner.com
- 23 Physics Olympiad Nat. Qualifying Exam. www.asi.edu.au/olympiads/ Ph: 6125 9645
- 26 Biology Olympiad Nat. Qualifying Exam. www.asi.edu.au/olympiads/ Ph: 6125 9645
- 31 Chemistry Olympiad Nat. Qualifying Exam. www.asi.edu.au/olympiads/ Ph: 6125 9645

SEPTEMBER 2010

- 2 Rio Tinto Big Science Competition: www.asi.edu.au/bigscience/
- 10, 13 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 23 Spring Equinox

OCTOBER 2010

- 10–16 Earth Science Week. www.earthsciweek.org & www.ga.gov.au/education/events/science-week/index.jsp Ph: 6249 9859
- 16 Astronomy Open Night & Lectures: Macquarie Uni, www.astronomy.mq.edu.au/
- 18, 22, 25, 29 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

NOVEMBER 2010

- 1 Biol & Environ. Sciences Science Teachers’ Workshop. Uni of Sydney.
- 2 & 3 Chemistry Science Teachers’ Workshop. Uni of Sydney.
- 4 & 5 Physics Science Teachers’ Workshop. Uni of Sydney School of Physics: <http://sydney.edu.au/science/physics/foundation/education/stw.shtml>
- 1, 5, 15, 19 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 22 Science Teachers’ Forum. Children’s Medical Research Institute. www.cmri.com.au
- 22, 26, 29 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

DECEMBER 2010

- 3,7–10,13–17 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 22 Summer Solstice (9.38 am EST)

- **JANUARY 2011** National Youth Science Forum. Forms to local Rotary club by 29/5/10, interviews from July. Only for Yr 11 in 2010. Enquiries: 6125 2777, email: nssf@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.

NOTE: Your purchase of the Odium & Garner Past HSC Biology, Chemistry and Physics books helps to support the production of Past HSC books for Earth & Environmental Science and Senior Science. Thank you to all the teachers who support these projects.

**2010
Science
HSC Examination Dates**

27 Oct Earth & Env Science: 1.55 pm–5 pm
3 Nov Chemistry: 9.25 am–12.30 pm
4 Nov Physics: 9.25 am–12.30 pm
5 Nov Biology: 9.25 am–12.30 pm
10 Nov Senior Science: 9.25 am–12.30 pm

2010 School Certificate Tests

8 November

- English: 9.20–11.30 am (includes 10 mins reading time)
- Science: 12.50–3 pm (includes 10 mins reading time)

9 November

- Maths: 9.25–11.30 am (includes 5 mins preparation time)
- Australian History, Geography, Civics & Citizenship: 12.50–3 pm (incl 10 mins reading time)

11–12 November (all schools do online test)

- Computing Skills Test (online): 8 am–5 pm

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★ ◆ ★ ◆ ★

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Australian wildlife is in trouble and needs your help! If you would like to help Australian scientists and conservationists, you can take part in this year's Night Stalk.

Twist Night Stalk is easy, fun and something everyone can do. All you need is a torch and a Spotter's Log. Choose one night or a number of nights between 1 September and 16 October and spotlight in your local bushland. Record all native/introduced animal

1 September–16 October 2010

species: mammals, birds, bats, reptiles and frogs, that you find and send your Spotter's Log to Perth Zoo.

This annual national survey, now in its 12th year, is designed to collect information about animals still living in the wild, especially near urban areas, and their distribution over time.

For information: [Twist Night Stalk](http://www.twistnightstalk.com)
 PO Box 489 South Perth WA 6151
 Fax: (08) 9474 4113
 Email: nightstalk@perthzoo.wa.gov.au
 Visit: www.perthzoo.wa.gov.au/Get-Involved/Nightstalk
 & download a Spotter's Log or complete one online.

Australian Museum School Programs 2010

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Download self-guided activities from the website such as:

- Biodiversity Trail and Clue Cards (Yr 5–8)
- Evolution Trail Combo (Yr 9–10)
- Evolution, Extinction and Survival (Yr 11–12)

Sessions with a Museum educator include:

- Fascinating Fossils (Yr 7–10)
- Human Story (Yr 11–12)
- Learning from Fossils (Biology) (Yr 11–12)
- Earth and Environmental Science Fossils (Yr 11–12)
- Indigenous Gallery Talks (Yr 7–12)



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'Sleep learning' – the importance of sleep in learning

Sleep does more than banish dark under-eye circles. Getting a good night's sleep before a big test and taking power naps while you study can help you get a better grade – even more so, if you dream about what you have been learning. According to an increasing amount of research in animals and humans, and thanks to advances in neuroscience scientists in recent years have determined that sleep is much more important than commonly believed.

The Harvard studies have shown that sleep improves some types of memory and learning. In particular it seems to secure memories, termed procedural memories, which help people learn skills, e.g. mastering a videogame, a gymnastics move or a melody on the piano.

Pulling an all-nighter doesn't work because learning requires a good night's sleep. Why six or eight hours, and not four or five? The sort of sleeping you do at the beginning of a night's sleep, and the sort you do at the end are different, and both, it appears, are required for efficient learning.

Sufficient sleep gives our brains a chance to integrate facts properly into our memory circuits. This process is also important to learning, as it reinforces and strengthens the many connections between nerve cells that make up the new memory. Like a child repeating a refrain to memorise it, the brain goes over what it has learned, until practice makes perfect. It would seem that our parents were right all along about getting a proper night's sleep!

A recent survey found that more people are sleeping less than six hours a night, and sleep difficulties visit 75% of us at least a few nights per week. A short-lived bout of insomnia is generally nothing to worry about. The bigger concern is chronic sleep loss,

which can contribute to health problems such as weight gain, high blood pressure, and a decrease in the immune system's power.

While more research is needed to explore the links between chronic sleep loss and health, it's safe to say that sleep is too important to short-change. The Harvard Women's Health Watch suggests 6 reasons to get enough sleep and not to scrimp on sleep:

- **Learning and memory:** Sleep helps the brain commit new information to memory through a process called memory consolidation. In studies, people who'd slept after learning a task did better on tests later.
- **Metabolism and weight:** Chronic sleep deprivation may cause weight gain by affecting the way our bodies process and store carbohydrates, and by altering levels of hormones that affect our appetite.
- **Safety:** Sleep debt contributes to a greater tendency to fall asleep during the daytime. These lapses may cause falls and mistakes such as medical errors, air traffic mishaps, and road accidents.
- **Mood:** Sleep loss may result in irritability, impatience, inability to concentrate, and moodiness. Too little sleep can also leave you too tired to do the things you like to do.
- **Cardiovascular health:** Serious sleep disorders have been linked to hypertension, increased stress hormone levels, and irregular heartbeat.
- **Disease:** Sleep deprivation alters immune function, including the activity of the body's killer cells. Keeping up with sleep may also help fight cancer. □

References

<http://healthysleep.med.harvard.edu/healthy/matters/benefits-of-sleep/learning-memory>
www.health.harvard.edu/press_releases/importance_of_sleep_and_health

Plastics are rotting

Plastics are far from indestructible. Many 20th-century artefacts that have become museum pieces are decaying fast, e.g. toys such as plastic train sets, Barbie dolls, as well as bakelite radios, and more.

Plastics became very popular because they could be moulded into many different shapes and had a range of soft to hard flexibility. However, in molecular terms, plastics are polymers and over time, the bonds that hold their chains together are attacked by oxygen in the air or ultraviolet photons in sunlight, or are simply broken apart by ambient heat.

PVC, once thought to be robust, was used for doors, windows, water pipes, etc. It decays autocatalytically, attacked by the hydrochloric acid produced when it begins to decompose.

Scientists have worked out additives to put into plastics to delay their aging, but these are costly and eventually these lose their effectiveness. □

[Source: *NewScientist* 19 June 2010]

EARTH SCIENCE WEEK

10–16 October 2010

Theme: 'Exploring Energy'

This aims to raise awareness of Earth Science and its significance and impact to every day life, education and society. *Exploring Energy*, the 2010 theme, aims to engage people in learning about Earth's energy resources as well as to remind them that Earth Science is all around us.

Geoscience Australia hosts Australia's Earth Science Week and has activities such as the *Geologi2010* student short film competition with the international theme.

Geoscience Australia's annual *Open Day* will be on Sunday 17 October.

For more information on events, go to: www.ga.gov.au/education/events/index.jsp □

Neuroplasticity in the human brain – and use it or lose it

The discovery of neuroplasticity, that our thoughts can result in new neurones being formed and so can change the structure and function of our brains, even into old age, is the most important breakthrough in our understanding of the brain in 400 years. Thus, the old adage ‘use it or lose it’ is brought soundly home. If one’s brain is constantly challenged by and engaged with a variety of stimulations and new experiences, while also exposed regularly to that which it already knows, it is better able to retain its adaptive flexibility, regenerative capacity, and remarkable efficiency throughout life.

Until recently, we have been using the wrong model for thinking about the brain as being like a complex machine with its different parts, each performing a single mental function. This led to the ‘mapping’ of the brain’s functions and speaking of the brain’s circuits as ‘hard-wired’ according to a genetic template and that these circuits were formed, and finalised, in childhood.

This doctrine of the unchanging, fixed brain meant that many born with mental

limitations, learning disabilities or certain psychiatric problems, or those who suffered brain damage or strokes, were seen, almost by definition, as condemned to live with them. Machines do many wonderful things, but they don’t grow new parts, or reorganise themselves.

Neuroscientists have now shown that with repetition our brain circuits can become better at what they do and fire faster, more efficient signals. These findings have already been used to cure many learning disorders and remedy a variety of psychiatric and neurological problems, treat strokes, raise IQs and preserve the ageing brain – all of which were previously thought to be incapable of change or recovery.

These findings amount to the discovery that the adult human brain, rather than being fixed or ‘hard-wired’, can not only change itself, but works by changing itself. Neuroplasticity refers to the property of the brain that allows it to change its structure and function in response to what it senses, what it does and even what it thinks and imagines

and this can happen from cradle to grave.

Principles that we can all use to overcome brain limitations and the profound brain implications of the changing brain are explored by Dr Norman Doidge in his book *The Brain that Changes Itself*. In this book, Doidge cites many personal stories to illustrate the brain’s plasticity, e.g. blind people learning to see, children with cerebral palsy learning to move gracefully, people with strokes learning to walk and talk again, amputees losing the pain caused by their phantom limb, and many more.

Doidge also outlines how the right mental exercises will help to fight off and reverse the onset of ‘senior’s moments’ that come with age-related memory loss – he describes how physical activity is important as exercise stimulates your sensory and motor cortices and maintains your brain’s balance system. Learning to dance helps to ward off balance problems and learning new things helps to exercise the brain, e.g. learning a new language or how to play a musical instrument. This book will permanently alter the way you look at your brain, human possibilities and human nature. □

Science Updates

● Anglo-Australian Observatory is now called *Australian Astronomical Observatory*

On 1 July 2010, the Anglo-Australian Observatory became the Australian Astronomical Observatory (retaining the iconic ‘AAO’ brand name) – this follows the withdrawal of the UK after a highly successful 35-year collaboration. The new AAO will now function under Australian Government ownership and management. □

● Mist versus fog

If water vapour condenses high up in the air it forms clouds. However, when water vapour condenses into tiny liquid water droplets in the air closer to the ground it forms mist or fog. Mist and fog are distinguished by their density or thickness – and this is expressed by how far we can see through them (i.e. the visibility) – in a fog you can see less than a kilometre, whereas in a mist you can see between 1–2 kilometres. □

● Humans and their use of plastic

According to Clean Up Australia, Australians use in excess of 6 billion plastic bags per year. Australia produces and uses more than 1.3 million tonnes of plastic each year. Making things from recycled plastic uses only 30% of the energy it would take to make it from new plastic, so placing your plastic in the recycling bin instead of the rubbish bin is definitely a good idea. □

● Element 112 named Copernicium

IUPAC officially approved the name copernicium, with symbol Cn, for the element of atomic number 112 in March 2010. So you now need to amend your Periodic Tables.

It has been more than a decade since this element was first detected in 1996 by a team of scientists led by Professor Sigurd Hofmann, from the Centre for Heavy Ion Research in Germany, after fusing atoms of zinc and lead in a particle accelerator. However, it wasn’t until 2009 that the International Union of Pure and Applied Chemistry (IUPAC) finally confirmed the element had been made – and that Hoffman’s team deserved

the credit. This resulted in element 112 being added to the Periodic Table in July 2009 and the name *copernicium* being proposed.

It has taken until 2010 for the name Copernicium to be ratified by IUPAC*, in order to give the scientific community ‘time to discuss the suggested name’.

* Note: IUPAC was formed in 1919 by chemists from industry and academia. For more than 90 years, IUPAC has fostered worldwide communications in the chemical sciences. IUPAC is considered the world authority on chemical nomenclature, terminology, standardised methods for measurement, atomic weights and many other critically evaluated data. More information about IUPAC is available at www.iupac.org □

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 Dec 3, 7–10, 13–17.

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[Note: Luna Park is usually only open on Mondays & Fridays – but will be OPEN EVERY DAY IN LAST 2 WEEKS OF TERM 4]

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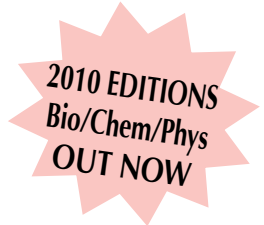
Physics is Fun was co-authored in 1983 by Robert Garner and Sylvia Jennings and was based on their earlier excursions at Luna Park in the 1970s. Robert has conducted these fun park excursions since their inception ... both at **Luna Park** (1983-1987, 1995, 2004-2010) and **Wonderland Sydney** (1990-2004) – covering many different subject areas. With the closure of Wonderland Sydney in early 2004, these Fun Park Excursions have been at **Luna Park Sydney** since its re-opening in April 2004.

Please note: Our excursion notes are only for use when on an excursion day booked through Physics is Fun. It is an offence under Copyright Laws to use them on any other occasion without written permission from Physics is Fun.

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PhoTo Spot

'Hairy balls' – a photomicrograph of PMMA spheres

PMMA (polymethyl methacrylate) spheres are microscopic synthetic polymer beads or microspheres. They are sometimes also called acrylic or perspex microspheres.

Microspheres are small spherical particles with diameters in the micrometre range ... from 10 μm to 1 000 μm (1 mm). Their final size and whether they are hollow or solid depends on the application for which they are needed.

PMMA is an inert substance that has been implanted in the body for nearly a century due to it being a proven and safe biocompatible substance. It has been used in dental work, as injectable dermal fillers (PMMA implantation can be used to improve the skin's contour and reduce depressions in the skin due to scars, injury or lines) and in many different biomedical devices, e.g. for ocular lenses, bone repair, artificial hips and limbs, and pacemakers since the early 1930s. Microspheres such as PMMA and other synthetic microspheres have been used in cosmetics for some time, primarily as fillers and exfoliators. The spherical shape and smooth surface of microspheres creates a low friction ball-bearing effect that gives formulations an elegant, silky feel. PMMA spheres are also used in a wide variety of industries, such as investigations in the colloidal crystal field and in toners for copying machines. The diameter specifications for these microspheres are dictated by the requirements of each application.

PMMA is made by reacting the monomer, methyl methacrylate, with a catalyst such as organic peroxide. The catalyst starts the reaction and enters into it to keep it going, but does not become part of the resulting polymer. The PMMA polymer is an amorphous (non-crystalline), transparent and colourless, synthetic thermoplastic that is hard and stiff. It has good abrasion and UV resistance and excellent optical clarity. It has somewhat poor solvent resistance. PMMA spheres are soluble in organic solvents such as acetone, benzene, or halogenated hydrocarbons.

Attempts by scientists to make PMMA biodegradable have failed. However, making a biodegradable microsphere with other polymers has been successful and is used in drug delivery (see Box 1).

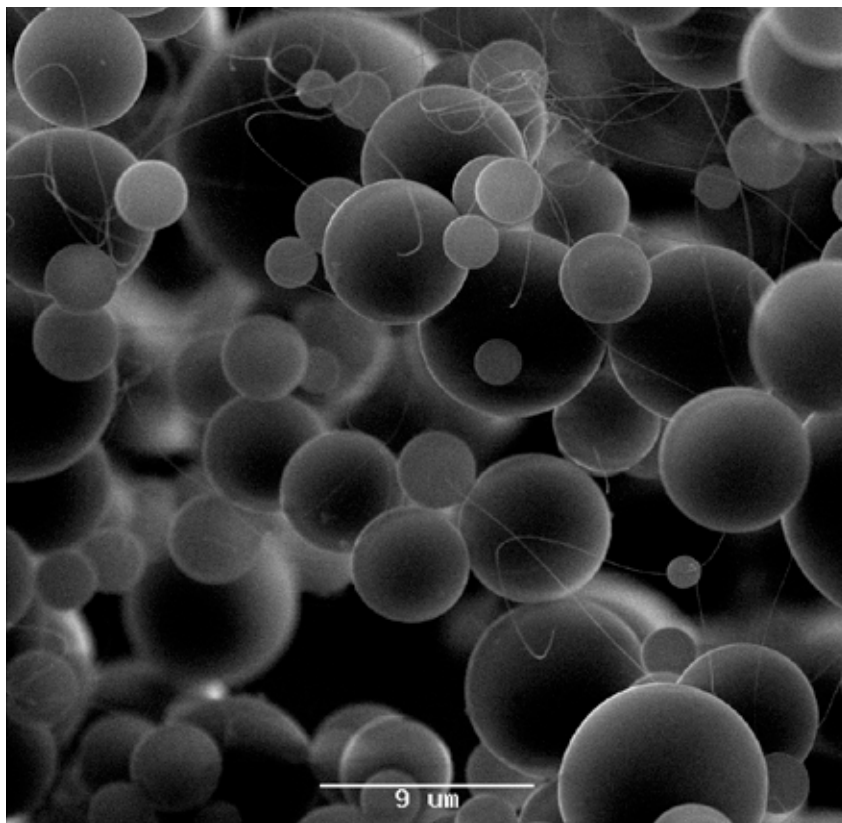


FIGURE 1: "Hairy Balls" – a scanning electron micrograph of spray dried PMMA spheres. This was taken by Dr Gerry Gadd, ANSTO.

BOX 1: Using Biodegradable Microspheres in Drug Delivery

In recent years, scientists have developed biodegradable polymeric microspheres for drug delivery. Delivering drugs through biodegradable microspheres has numerous advantages compared to conventional delivery systems. While in conventional systems the drug is usually released shortly after delivery and stops working after a brief period of time, a biodegradable polymer offers a way to provide sustained release over a longer time, thus eliminating the need for multiple doses and ensuring sustained and controlled drug delivery over weeks or months.

*"When you have been wronged,
a poor memory is your best response."*

... unknown

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Hummingbirds – minuscule, but mighty

Among the smallest of birds, hummingbirds include the smallest bird species in the world, the Bee Hummingbird, which has only 5 cm body length. Even the largest of hummingbirds, the Giant Hummingbird, is only 20 cm long.

Hummingbirds are so-called because of the characteristic hum made by their rapid wing beats. They can hover in mid-air by rapidly flapping their wings 12–90 times per second (depending on the species). They can also fly backwards, as well as up and down and are the only group of birds able to do so. They can instantly change direction from just hovering, due to their upper wing bone being able to rotate more than 180° in the shoulder socket. They can fly at speeds exceeding 15 m/s (54 km/h).



FIGURE 1: A female Black-chinned Hummingbird (*Archilochus alexandri*) is small with a body length of only 8.25 cm. Adults are metallic green above and white below with green flanks.

Senior Science excursion

Many of the first-hand experiences in the Senior Science syllabus are covered by doing an excursion at Luna Park Sydney:

✦ **Preliminary Topic 8.4 Humans at Work** – students assess the impact of science in the design/construction of safe rides; identify & assess potential hazards & factors that increase the risk of injury; perform an occupational health & safety style audit; & determine what safety measures are needed to protect the human body from injury.

✦ **HSC Option 9.8 Disasters** – students explore the possible consequences of a disaster such as the collapse of a ride at Luna Park Sydney, and how emergency services would assist in the minimisation of the effects of such a disaster.

✦ **HSC Topic 9.4 Information Systems** – students investigate the need/use of these.

✦ **HSC Option 9.5 Polymers** – students investigate the types used & their impact.

Interactive learning is a great way for students to learn and have fantastic fun at the same time. What better way to put fun into your lessons than to do a Physics is Fun *Senior Science excursion* at Luna Park Sydney! For details, see page 6 of this *SciTalk*. Enquiries are welcome – ph/fax: (02) 9939 6107. □

Jeans for Genes Day ... 6 August 2010

Chances are you probably know someone who has a genetic disease, because one in twenty children are born with some form of genetic fault. There are children with leukaemia, muscular dystrophy, genetic defects and many other disorders. Scientists at the Children's Medical Research Institute are working to try to prevent these diseases before they occur in our children, or where that is not possible to develop better treatments.

Jeans for Genes Day is so much fun and really easy to get involved. It's a day where everyone can wear jeans and simply make a donation or buy a badge, whilst supporting a great cause – helping today's scientists for tomorrow's children.

You can be a Genie in your school – and help out on *Jeans for Genes Day* by promoting the event, collecting donations and taking care of anything that makes the day fun. You can also raise money by selling *Jeans for Genes Day* products. If you would like to help raise funds or make a donation, call 1800 436 437 or get online at www.jeansforgenes.org.au/ □



Monkey intellect catapults

Monkeys at a research institute in Tokyo, Japan have used the branches of trees to catapult themselves over an electric fence.

A group of 15 monkeys at Kyoto University's primate research institute in Aichi Prefecture escaped from their forest home, which is encased by a five-metre-high electric fence. The monkeys made their break for freedom by bending and releasing tree branches to fling themselves over the fence.

Despite the intelligence demonstrated by their great escape, the primates appeared unsure about what to do with their freedom:

they remained by the gates of the centre and were lured back by scientists with peanuts. 'We think that maybe there was some kind of dispute among the monkeys in the forest and so this group decided to leave,' Hirohisa Hirai, the deputy head of the institute, said. 'Fortunately, they stayed by the fence after escaping as they probably wanted to stay near to the other monkeys.'

Scientists have since cut the trees in order to prevent a repeat escape. The Kyoto institution is one of the world's leading primate research centres, which has produced a series of studies exploring the social interaction, behaviour and evolution of primates. □

[Source: www.smh.com.au (13/7/10)]



Enjoy the night skies!

... Robert Garner & Catherine Odum

The Winter night skies going into Spring may be cold, but they often provide better viewing than other times of the year ... as long as you rug up!

The Constellations

Get out your sky charts and/or planispheres (see Box 1), as this is a great time to explore the night skies with either the naked eye, binoculars or, if you have one, a telescope.

Sagittarius ('The Teapot') with its distinctive shape can be easily located by facing north and then looking directly overhead around 10 pm in early August, and a bit earlier each subsequent night. It will be overhead at 9 pm by mid-August and around 8 pm in early September. *Scorpius* can be located to the west of *Sagittarius* and *Capricornius* to its east. All three of these zodiacal constellations will be high in the sky.

You can also use the Moon to locate these constellations – from 17–20 August and again from 14–17 September. On 14 September, the bright red star *Antares* (in *Scorpius*) will be to the left of the Moon. This star is often referred to as the 'red heart of the scorpion'. *Antares* is a red giant star that is much cooler than our Sun and so glows red. It is also much larger than our Sun with a diameter that is greater than the orbital diameter of the planet, Mars.

Slightly to west of south, the Southern Cross (*Cruce*) can be seen lying on its side with the pointers α - and β -*Centauris* above and nearby.

The Planets

Mercury will be in the western sky just after the end of evening twilight in early August. On 12 August, a 3-day old crescent Moon will be just above it. After this, its approaching conjunction with the Sun on 3 September means it will be lost from view. Mercury will be hard to see again until November as it remains close to the horizon.

Mars, *Venus* and *Saturn* will put on a good display throughout August, particularly from 8–19 August, in the western night sky. In the second week of August, the new crescent Moon helps to locate these planets as it will pass by the three planets. On 13 August, the Moon will be to the left of Venus. Although as winter progresses, Venus gets higher in the sky and Saturn gets lower, the three planets will remain close in the sky. In the early evening at the start of September, the new Moon again passes by these planets and so helps again to locate them. By late September, Saturn will have disappeared into the evening twilight as it approaches conjunction on 1 October.

Jupiter will be visible in the late evening eastern sky during August, but will be earlier each night. Around 26–27 August and again from 22–23 September it will near the Full Moon. By the end of August and during September, Jupiter will be visible all night. It is approaching its opposition on 21 September when the Earth will pass between the Sun and Jupiter. Oppositions occur every 13 months. This is a particularly favourable opposition for observing Jupiter, as the planet will appear at its biggest and brightest. At each opposition from now until 2017, Jupiter will appear slightly smaller and slightly fainter.

Spring Equinox

The Spring Equinox occurs at 1.09 pm (AEST) on 23 September 2010. At this time, the Sun crosses the celestial equator, which it does twice a year – in spring and in autumn. The word 'equinox' derives from Latin words meaning 'equal night'. The name implies equal amounts of night and day, but this is only really true if you are on the equator. During an equinox, the length of night and day across the world is nearly, but not entirely, equal. This is because the day is slightly longer in places that are further away from the equator, and because the Sun takes longer to rise and set in these locations. □

Some Aboriginal perspectives on the Sun and the Moon

In most Aboriginal cultures, the Moon is male, although sometimes it is a female. The Sun is usually a female. In most versions, the life-giving force is associated with the Sun.

The Yolngu people say that the Sun-woman, Walu, causes the daily motion of the Sun across the sky and back again under the ground. She lights a fire each morning at her camp in the east and so creates dawn. Some of the red ochre she decorates herself with lands as dust on the clouds creating sunrise. Her torch made from the stringy-bark tree blazes during the day to create daylight. Then at the end of her journey across the sky, more ochre dusts the clouds to create sunset. Her torch goes out and nightfall occurs. The Sun-woman stays underground during the night and makes her way back to her camp in the east.

Amongst the Murray River tribes, the origin of the Sun is linked to the tossing of a giant emu egg into the sky where it struck a heap of dry wood and burst into flame, bringing light to the previously dark world. The Great Spirit Baiame, seeing how much the world was improved by sunlight, decided to rekindle the woodpile each day.

There are many different stories about how the Moon got into the sky. According to the Yolngu people, the Moon-man, Ngalindi, is fat and lazy and so his wives chop bits off him producing a waning Moon. This causes him to die for 3 days. Then he gets reborn as a new Moon. The cycle keeps repeating because he grows fat and round again and so his wives attack him again. The Kuwema people in the Northern Territory say that he grows fat at each full Moon by devouring the spirits of those who disobey the tribal laws. Another story recounts how Ngamarna had two nephews who asked their uncle to climb a gum tree for witchetty grubs. As they ate the grubs the nephews made the tree grow taller and taller. Then they cut the tree down, leaving their uncle up in the sky to shine and become the Moon and married his wives. Two further dreaming stories on the Moon's origin are recounted in *SciTalk No. 1-2009* (see Box 2).

Various Dreaming stories demonstrated an understanding that eclipses were caused by a conjunction between the Sun and Moon moving on different paths across the sky, occasionally crossing. A *solar eclipse* is often described as the Moon man uniting with the Sun woman. In the legends of inland tribes, the Sun goddess fell in love with the Moon and pursued him across the sky. Although he

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On clear nights, our 'starfinder' (planisphere) sessions demonstrate how to identify bright stars, constellations and planets. This is followed by observing with the 12" & 16" Meade telescopes. Even with the light pollution of the city, we can easily see double and multiple stars, open and globular star clusters, and the brighter nebulae. The Moon and planets, when in suitable positions, are easily viewed with any of our instruments. On dark, moonless nights, we may also observe the brightest galaxies. In the event of cloud, our program includes a mixed al fresco presentation of slides, posters and scale models.

Located in the grounds of Macquarie Uni (access via Gymnasium Rd), the observatory is open to the public every Friday night, March–Nov inclusive, 7.30–9 pm. Bookings are essential – ph 9850 4409 or email starinfo@mq.edu.au before 4 pm. If doubtful weather, phone 9850 8914 or check at www.astronomy.mq.edu.au/observatory/

was sometimes eclipsed, he always managed to escape from her but never permanently – as she instructed the spirits who hold up the edges of the sky to turn him back whenever he tried to slide down to Earth. The Warlpiri people explain a solar eclipse as being when the Sun-woman is hidden by the Moon-man as he makes love to her. A similar story was reported from the Wirangu people who explained a solar eclipse as being due to ‘the Sun and Moon becoming husband and wife together’. A *lunar eclipse* was explained as being when the Moon-man was threatened by the Sun-woman who was pursuing and trying to catch up with him.

Other stories account for the *Moon’s waxing and waning*. The Boorong people in Victoria saw Mityan, the Moon, as being the quoll or native cat because of the half, full and crescent moon shapes on its fur coat. Mityan was beaten after trying to entice someone else’s wife to run away with him and so has been wandering ever since at night-time like the quoll. Coastal Aborigines, such as the Bardi in WA and at Yirkala in Arnhem Land and on Groote Eylandt, noticed a correlation between the phases of the Moon and the tides. When

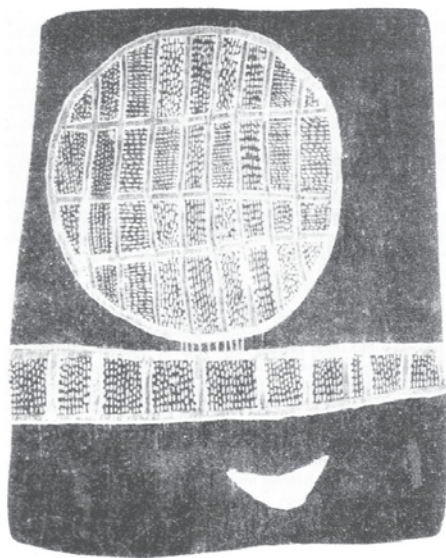


Figure 1: Drawing of a bark painting from Groote Eylandt showing the full Moon with lines on the lower edge indicating the water running into the Moon from the sea (the horizontal band), The new Moon is shown at the bottom as a crescent.

Credit: Mouniford Collection, State Library of SA.

the Moon is new or full and sets at sunset or sunrise respectively, the tides are high, and when the Moon is in the zenith at sunrise or sunset, the tides are low. They believed that the high tides, running into the Moon as it sets into the sea, made it fat and round, and when the tides were low, the water poured out of the full Moon into the sea below, so it became thin. They could still see the faint outline of the Moon’s full circle and so were puzzled, as it still appeared to be full of water.

The full Moon was often associated with ceremonies involving large groups of people, storytelling, song and dance. This had the advantage of maximum night light and a greater chance of calm weather as this was associated with full Moons. Disputes would regularly be dealt with first and then the ceremony would begin and often continue all night.

In most areas, the Moon was also regarded as a warning against immoral activities. Because the lunar cycle was associated with the menstrual cycle, the Moon was linked with fertility and young girls were warned against gazing at the Moon, unless they wished to become pregnant. □

References:

‘Searching for the Astronomy of Aboriginal Australians’ by Ray P Norris (2007) www.atnf.csiro.au/research/AboriginalAstronomy/whatis.htm
<http://emudreaming.com>
 ‘Explorers of the Southern Sky’ Haynes, *et al* (1996)

BOX 2 Cumulative index for ‘Some Aboriginal perspectives on astronomy’ series

You can read past articles in the ‘Aboriginal perspectives on astronomy’ series by going to the following past issues of *SciTalk* at www.odlumgarner.com –

- The Emu ... *SciTalk* No. 1-2004
- The Southern Cross ... *SciTalk* No. 3-2008
- The Moon ... *SciTalk* No. 1-2009
- Pleiades ... *SciTalk* No. 2-2009
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- Venus ... *SciTalk* No. 2-2010
- The Sun and Moon ... *SciTalk* No. 3-2010

Remember that dreaming stories and characters vary among Aboriginal groups. Although they may share many of the same beliefs, the messages and the characters in their stories are different. The various Aboriginal groups divided the night sky into about 40 different constellations. They named them after different native birds and animals, including crows, eagles, parrots, lorikeets, emus, eagles, tortoises, kangaroos, brolgas, dancing men and song men. □

BOX 1 Sky Charts & Planispheres

- You can download free sky charts each month to explore the night sky from: <http://skymaps.com/downloads.html>
- A planisphere (star wheel) is a great aid for exploring the stars and locating constellations. These are inexpensive and available from astronomy shops, or you can download one from the internet – make sure it is for the Southern Hemisphere. There is a planisphere (star wheel) to print and use at: <http://members.ozemail.com.au/~starrylady/Planis1.htm>

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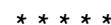
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- SciTalk No. 3–August 2010 ... July 4
- SciTalk No. 4–October 2010 ... Sept 27

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