Providing support and promoting excellence in science education

SciTalk

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Number 3 – August 2006

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THE LEADING EDGE
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The Leading Edge Student Study Guide series published by Harcourt Education provides sequenced revision, and relevant exam preparation, practice and guidance to help students successfully complete exams.

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★ ★ ★

Winner for *SciTalk 2/06*

Congratulations to Ivan Hooper, Glendale Technology HS who won *Science Tests for the School Certificate* ($32.95 ea) by Catherine Odlum *et al*, published by Odlum & Garner.

★★ ATTENTION ★★

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

☐ 1. .....
☐ 2. .....
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☐ 4. .....
☐ 5. .....

Please return to file or noticeboard.

PRIZES TO WIN!

See pages 1, 4, 5 & 12
Send in your entries now
(ALL IN THE ONE ENVELOPE if you prefer!)

This *SciTalk* & past issues are available at
http://homepage.mac.com/robertgarner

Danger lurks in every classroom

You may not have peanuts in your classroom for a student to eat, but peanuts can be lurking in baby lotions or hand creams on someone's skin, or on people's breath, lips or skin after eating something containing peanuts. Even minute quantities such as these can affect students who are allergic to peanuts.

Students can also be allergic to allergens other than peanuts, e.g. other foods, insect bites (e.g. bee, wasp, jumper ants), medications (e.g. antibiotics, aspirin), and latex (e.g. rubber gloves, balloons, swimming caps, condoms).

Teachers need to know how to appropriately manage incidents of adverse allergic reaction, also known as 'anaphylaxis'. A publication, *Anaphylaxis Guidelines for Schools* to help teachers is available on the internet at: *www.health.nsw.gov.au/pubs/a/pdf/anaphylaxis.pdf* This was produced jointly by the three school systems and NSW Health in the light of the death on a school excursion of a student in 2002.

Although death is rare, anaphylaxis is potentially life threatening and always requires an emergency response. Prompt treatment with injected adrenaline is required to halt progression and can be life saving. Fortunately anaphylactic reactions are uncommon and usually preventable by implementing strategies for avoiding allergens.

The early recognition of the signs and symptoms of anaphylaxis may save lives by allowing the earlier administration of first aid and contact of the appropriate emergency medical services. Teachers need to make sure that they are familiar with the early signs, know what to do and how to inject an EpiPen (refer to *Anaphylaxis Guidelines for Schools*).

Unlike other allergenic foods, such as eggs and milk, peanuts cause extremely potent allergic reactions. An analysis of food-allergy deaths in the US in 2001 found that up to 90% were caused by peanuts and other nuts, resulting in more than 100 deaths every year.

One study in the UK has shown that peanut allergies in children apparently doubled

... continued on page 4

Celebrate National Science Week in August 2006

EDUCATIONAL EXCURSIONS & FUN DAYS AT LUNA PARK SYDNEY

for primary & secondary students through Physics is Fun

★ **Secondary**: Science 7–10, Physics, Biology, Senior Science, Maths, Technology, Visual Arts, Peer Support, Commerce, Business Studies, Tourism
★ **Primary**: Science & Technology, English, Mathematics, Art & Peer Support

Save $$$ ... special DISCOUNT PRICES FOR SCHOOLS: see p 7

INSIDE SCITALK ▶▶▶▶

Why pay more?

SPECIAL SCHOOL PRICES

are available for ALL subject areas for Fun Park Excursions to Luna Park Sydney through Physics is Fun. *See p7.*

Diary Dates 2006

2006 – International Year of Deserts & Desertification

AUGUST 2006

12–20	National Science Week: Theme – Our Dry Continent. http://scienceweek.info.au/
18, 21	Science Week events: Physics is Fun at Luna Park. http://homepage.mac.com/robertgarner
12–20	Australian Science Festival, ACT. School Activities 16/8–18/8. www.sciencefestival.com.au
20 & 25	Faraday Lecture 2006. See Out & About on page 2 in *SciTalk* 2/06
23	Physics Olympiad National Qualifying Exam. www.aso.edu.au Closing date: 28 July
30	Biology Olympiad National Qualifying Exam. www.aso.edu.au Closing date: 28 July
late Aug/early Sept	Science Teachers' Workshop for Physics. Armidale. Uni of Sydney. (02) 9351 3622

SEPTEMBER 2006

1 Sept– 16 Oct	Great Australian Marsupial Night-stalk. www.perthzoo.wa.gov.au/nightstalk/
2	Astronomy Open Night & Lecture. Macquarie Uni E7B. 6–10 pm. (02) 9850 7111, www.physics.mq.edu.au/astronomy/cal.html
6	Chemistry Olympiad National Qualifying Exam. www.aso.edu.au Closing date: 28 July
7	National Threatened Species Day. www.deh.gov.au/biodiversity/threatened/ts-day/ & www.deh.gov.au/biodiversity/threatened/information/
14	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
23	Spring equinox
30	BHP Billiton Science Awards closing date http://scienceawards.bhpbilliton.com

OCTOBER 2006

8–14	Earth Science Week 2006. www.earthsciweek.org/
19 Oct–17 Nov	HSC exam period. Full timetable available at: www.boardofstudies.com.au
20, 23, 30	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

NOVEMBER 2006

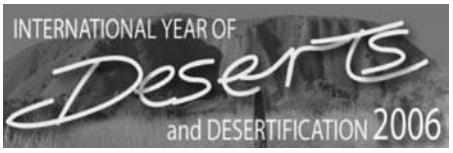
3,13,17,24,27,30	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
13–17	School Certificate Tests (see box on this page for details)

DECEMBER 2006

1, 8	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
19	HSC results released.

JANUARY 2007 National Youth Science Forum. Forms to local Rotary club by 15/5/06, interviews July. Only for Yr 11 in 2006. Enquiries: 6125 2777, fax 6125 8015, 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.



Failure is the opportunity to begin again more intelligently

... Henry Ford

2006 School Certificate Tests

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

14 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)

15–17 November *(each school on one of these days)*
- Computing skills test

2006 HSC Science Examination Dates

27 Oct	Physics: 9.25 am–12.30 pm
1 Nov	Earth & Environmental Science: 1.55–5 pm
2 Nov	Senior Science: 1.55 pm–5 pm
6 Nov	Biology: 9.25 am–12.30 pm
10 Nov	Chemistry: 9.25 am–12.30 pm

The Great Australian Marsupial Night Stalk

in partnership with Tiwest

The Great Australian Marsupial Night Stalk
1 September–16 October 2006

Many Australian marsupials are on the brink of extinction and need your help. If you would like to help Australian scientists and conservationists, you can take part in this year's Night Stalk.

Anyone can do a Night Stalk survey – all you need is a torch. It's fun! It's free, and easy to do! Get a group together, count the number of marsupials you see in your local bush, record your findings on a spotter's log and send your results to Perth Zoo.

This annual national survey, now in its 9th year, runs from 1 September–16 October, and is designed to collect information about marsupial and feral animal numbers and their distribution.

For more information, please contact:
Lyndsay Fairclough
The Great Australian Marsupial Night Stalk
in partnership with Tiwest
Ph: (08) 9474 0497 Fax: (08) 9474 4113
Email: nightstalk@perthzoo.wa.gov.au
Visit: www.perthzoo.wa.gov.au/nightstalk/

PERTH ZOO

TIWEST

Update on BOS matters

Check the BOS website regularly to ensure you have the latest information. This website contains syllabuses (K–12), past exam papers, Official Notices, Board Bulletins, a statistics archive and more.

Format of SC Science Test changed
Reminder: the format of the SC Science Test has changed. It is now 2 hours, there will be a stimulus book for use in both Sections 1 and 2, and questions 51–60 will be in Section 1. There is a new Specimen Test on the BOS website. (see *BOS 22/06*)

2006 School Certificate Science Specimen Test Package
This is available, with a mapping grid, on the BOS website.

Approved calculators for use in HSC 2006
The updated list of permitted calculators is at: www.boardofstudies.nsw.edu.au/manuals/calculators_hsc06.html (see *BOS 1/06*).

On BOS website:
- **HSC Marking Centre Notes & Guidelines**
- **Past HSC exams** and **SC Science Tests**
- **Amended Periodic Table** *(BOS 22/05)*

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.

Attention: Year Advisers

End-of-year Fun days / Reward days at Luna Park Sydney are cheaper if they are a Peer Support excursion.

(as only curriculum-based excursions to a fun park can claim back the GST)

Fun Park Excursions

Sydney's LUNA PARK just for fun

SPECIAL SCHOOL PRICES through Physics is Fun!

WHY PAY MORE? SAVE $$$ ANY FACULTY CAN COME

★ ✧ ★ ✧ ★

Come for a **FUN DAY** or **EDUCATIONAL DAY**!
These days are held throughout the year and are a great way to have FUN learning (see p 7).

Worksheets are available for:
• Primary Science & Technology, English, Maths
• Science 7–10 • Technology • Maths
• Physics • Senior Science • Biology • Art
• Peer Support • Commerce/Bus. Studies/Tourism

NATIONAL SCIENCE WEEK DATES
18 and 21 August 2006

Book your date now by ph (02) 9939 6107.
*** Includes complete Risk Assessment package! ***

OUT AND ABOUT

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SERVICING SCIENCE TEACHERS' CURRICULUM AND FIELDWORK NEEDS OVER THE LAST 6 YEARS

Ecosystems investigated:

- Coastal
- Rainforest
- Mangrove
- Rock Platform
- Sand Dune

Student booklets, pre & post material, data gathering and full instruction provided

Call 02 4234 3278
www.landsedge.com.au

SCIENCE IN FOCUS AT IMAX

IMAX THEATRE

31 Wheat Rd, Darling Harbour, Sydney 2000

★ **NOW SHOWING FOR SCIENCE GROUPS:**

Available in Terms 3 and 4, 2006!

- *Deep Sea 3D* (new)
- *Antarctica*
- *Bugs 3D*
- *Forces of Nature*
- *The Human Body*
- *Roving Mars*
- *Space Station 3D*

Available for school bookings now.

★ **COMING SOON:**

- *The Ant Bully 3D* (animated feature-length film) … starts 28 September 2006
- ***DINOSAURS 3D*** … starts Term 1, 2007

★ For other films and their session times, please visit: ***www.imax.com.au/schooltimetables***

Science Teachers' Forum

To be held at the
CHILDREN'S MEDICAL RESEARCH INSTITUTE
Westmead, Sydney

Tuesday 21 November 2006
9.45 am–4.30 pm

This one-day Science Teachers' Forum will focus on the science of genetics and disease, concentrating on topics relevant to the HSC Biology syllabus.

The forum will include an introduction to the use of **Gene Technology** in medical research, followed by captivating presentations from two prominent CMRI research scientists on **Cancer Genetics** and **Nerve Cell Communication**.

There will also be an informative session devoted to the topic of genetics and ethical issues followed by interactive hands-on practical laboratory demonstrations of simple DNA-based techniques.

CHILDREN'S MEDICAL RESEARCH INSTITUTE

Places will be limited, so please book by ***Wednesday 12 October 2006***

Contact: Dr Jane Fleming **02 96872800** or email: **jfleming@cmri.com.au**

UNSW Medical Sciences Schools Programs

At Museum of Human Disease & Hall of Health

The Museum of Human disease is a pathology museum offering interactive programs with amazing insights into the nature and progression of disease in its many forms. Curriculum-based Biology/ Senior Science programs are available. These include:

- 2 hr workshops for Biology students on 'The Search for Better Health'
- 2 hr workshops for Senior Science students learning about 'Bionics'
- 2 hr workshops covering micro-organisms, infectious and non-infectious diseases included in the Science 7–10 Syllabus
- Latest exhibition on digestive system & dietary disorders: *Gutsy Stuff*

★ **NEW LOCATION:** Gr'd floor, Samuels B'lding, UNSW (map is on web)
Cost: Student workshops $8/student (GST exempt). Bookings are essential.
Enquiries: Ph (02) 9385 1522. Fax/ph (02) 9385 1747
Email: museum.hallofhealth@unsw.edu.au
Website: http://hallofhealth.med.unsw.edu.au

SCIENCE CENTRE & PLANETARIUM

University of Wollongong
Squires Way, Fairymeadow
Only 45 mins from southern Sydney.

★ ***Taking bookings for 2006!***

★ **Star Trails Outreach Program 2006** – we visit schools with a portable planetarium and interactive Science Shows.

★ We have an extensive range of ***shows & exhibits***, including:

- **Stellar Evolution** – planetarium program for HSC Physics
- **Superconductors & Liquid Nitrogen** – live science show
- **Zap! Understanding Electricity**
- **Energy and Motion**
- **The Changing Earth**

★ School entry includes two floors of hands-on exhibits, a science show, plus a ***planetarium / laser show***.

★ ***Also available***: environmental field trips, science shop, kiosk, science fun bags, membership programs.

★ ***Book now*** for your school excursion.
For information and bookings, phone (02) 4286 5000.
Website: sciencecentre.uow.edu.au

COMBINE A FUN PARK EXCURSION AT LUNA PARK SYDNEY WITH EITHER IMAX / SYDNEY AQUARIUM

You can combine a Fun Park Excursion at Luna Park Sydney booked through Physics is Fun with a visit (before or afterwards) to either IMAX or SYDNEY AQUARIUM for a great action-packed, fun time of interactive learning. These excursions are a great way to capture students' interest and demonstrate learning in action.

• COSTS, BOOKING DETAILS & WORKSHEETS – GO TO:

IMAX: www.imax.com.au/schooltimetables
SYDNEY AQUARIUM: www.sydneyaquarium.com.au
PHYSICS IS FUN: http://homepage.mac.com/robertgarner

• PLANNING YOUR DAY:

Allow 1 hr for IMAX (any film),
or 2 hrs for a Sydney Aquarium excursion.
Allow 2–3+ hours for Luna Park Sydney (open 11 am–6 pm)

BOOK & PAY SEPARATELY FOR EACH EXCURSION

Danger lurks in every classroom

... continued from page 1

between 1989 and 1995, and a similar rise occurred in the US between 1997 and 2002. At this rate, it is estimated that about 1% of the US population are allergic to peanuts.

It is still not known why such an increase has occurred in peanut allergies. Although genetics plays a part in acquiring an allergy, it would be hard to explain this increase in terms of genes alone. One simple explanation being investigated in the increase in the amount of peanuts we now consume. Allergenic foods are often things a population eats a lot of. There is anecdotal evidence that peanut allergies follow wherever an American diet goes, e.g. Poland prior to the breakup of the USSR in 1991 had almost to peanut allergy in the population, but 5 years later, Poles had a peanut allergy prevalence similar to the UK.

Since the immune system is not mature until after about three years old, some researchers proposed a link between the age at which a child is first exposed to peanuts and their developing peanut allergies. Studies have shown that this idea is probably incorrect.

Current studies are investigating the effect of being exposed to peanuts from birth to avoid sensitisation. This has been inspired by the millions of allergy-free children in countries such as southern and western Africa and Asia where peanuts are eaten frequently and there is little peanut allergy. Researchers are also looking at the effect of their different ways of cooking peanuts. An interesting complication however is that many Africans have parasites, and living with parasites seems to confer some protection against all kinds of allergies.

Researchers also hope to start trialling an immunotherapy treatment in 2007 for peanut allergy sufferers which will involve giving them progressively larger doses of peanut flour or peanut protein extract to eat. This was a successful treatment peanut-allergic mice.

Another immunotherapy treatment being investigated involves using a mix of Chinese herbs that include anti-inflammatory and vomit-quelling herbs. □

* * * * *

This article is based on "Dining with death" by Anna Gosline. The full article is in NewScientist 24 June 2006 *and is worth reading.*

Domestication sets dog genes free

There are over 350 distinct breeds of dogs – affectionately known as 'man's best friend'. Dogs have been bred for many purposes, e.g. hunting, pulling sledges, tracking, herding, and companionship.

Although Darwin proposed that dogs evolved from several wild canines such as jackals, coyotes and wolves, it is now known that all breeds of dogs evolved from one species, the grey wolf. What is not known though, is how the DNA of just one wolf could evolve into so many different breeds.

Researchers have now analysed the mitochondrial DNA of dogs and wolves and believe that mutations in the canine genome played a big role in dog evolution. With relaxed natural selection operating, due to humans domesticating dogs, mutations were not weeded out as they would have been normally. Researchers think that it would not have taken a large number of mutations to generate a lot of diversity. Scientists have only studied mutations in mitochondrial DNA and realise that there would have been less mutations in nuclear DNA. Therefore mutations are probably only partly responsible for all the differences in dogs. It is also thought that there was probably considerable variation in the ancestral wolf-dog population. □

NewScientist 24 June 2006

New genetic engineering tools

It is just 30 years since researchers discovered how to 'cut and paste' short pieces of DNA from one strand to another in a test tube. Genetic engineering over the years has involved a lot of 'hit and miss' for inserting and removing DNA. Recently developed 'molecular scissors' are set to become a key tool in genetic engineering as they will enable alteration of DNA inside a cell and will help scientists to cut DNA at a specific point. Another new technique is the adding of DNA with a recombinase.

These techniques are bringing gene therapy closer to being able to precisely insert and remove DNA segments. This will mean that faulty genes can be removed at the same time as corrected genes are inserted. □

NewScientist 24 June 2006

Science on the Web

New topics on NOVA: Science in the News – *www.science.org.au/nova*

- **Prions**

Prions cause deadly brain diseases. But how do they cause disease and what is their normal role in the body?

The discovery of prion proteins as infectious agents began in the 1980s with an outbreak of mad cow disease in the United Kingdom.

This article looks at the symptoms and pathology of mad cow disease; its first diagnosis and why it appeared; Kuru disease; Creutzfeldt-Jakob disease; what causes spongiform encephalopathies; how the scrapie microbe has no genes; prions – how these infectious agents are made and what they do; prion genes are in the host DNA; transmission of animal spongiform encephalopathies to humans; how similarity in prions is required for transmission between species; and the situation in Australia.

A related article worth reading: 'Getting our heads around the brain'.

- **It's an advanced material world**

Advanced materials promise to meet consumer demand for lighter, cheaper, faster and better products.

Advanced materials outperform conventional materials, e.g. in toughness, hardness, durability and elasticity – and result in the design of new products, including medical implants and computers. They can have novel properties, e.g. the ability to memorise shape or sense environmental changes and respond. Advanced materials are versatile, e.g. teflon makes windscreen wipers work smoothly and quietly, makes carpet and upholstery stain-resistant, and frypan surfaces non-stick. This article describes some advanced materials and future technologies they will make possible.

- **Making every drop count**

Would you drink treated effluent? This has become a heated national debate, as people try to find solutions to the lack of water supplies brought about by climate change and a growing population.

Wastewater has been recycled and used in Australian towns and cities for decades, but usually for watering parks and golf courses. A recent proposal for one drought-stricken Australian community to recycle sewage and use it to top up drinking supplies has made a lot of people unhappy. □

WIN A FAMILY PASS TO SYDNEY AQUARIUM

Sydney Aquarium at Darling Harbour is a great science excursion venue. It showcases Australian aquatic habitats, their fauna and flora, information on habitat characteristics, animal adaptations and conservation issues. Bookings are essential, excursions are self-guided. Information: *www.sydneyaquarium.com.au*

* * * * *

TO WIN A FAMILY PASS TO SYDNEY AQUARIUM: (for 2 adults & 2 children worth $66) … send in your name, school, & home address on an envelope by **29 September 2006** to:

Sydney Aquarium Teacher Offer, PO Box 442, Harbord NSW 2096

WINNER: Karen Wallwork, Gorokan HS, won the Sydney Aquarium family pass for *SciTalk No. 2–2006.*

WIN A FAMILY PASS TO IMAX

IMAX Sydney, at Darling Harbour, is open every day. More than 8 storeys high, it has the world's biggest cinema screen to give audiences the ultimate film experience. IMAX films are both entertaining and educational. Films are constantly changing and cover a wide range of themes. High quality resource materials & teacher guides are provided for school visits.

★ ✧ ★ ✧ ★ ✧ ★

TO WIN A FAMILY PASS* TO IMAX: (for 2 adults and 2 children worth $50) … send in your full name, school, home address & ph no. on an envelope **by 29 September 2006** to:

IMAX Give Away, PO Box 442, Harbord NSW 2096

* This pass will be valid for any one film for any session, except public holidays and films advertised as 'no free list'.

WINNER: Jane Moulder, Great Lakes College, Tuncurry campus won the IMAX Sydney family pass for *SciTalk No. 2–2006.*

AUSTRALIA'S SCIENCE OLYMPIANS RETURN VICTORIOUS

AUSTRALIAN SCIENCE OLYMPIADS

It's time to celebrate the remarkable efforts and achievements of our 2006 Science Olympian students.

These students demonstrated great talent at the 2006 International Science Olympiads held during July in Singapore (Physics), Argentina (Biology) and South Korea (Chemistry). The 2006 medal tally for these 'Olympic Games of Science' included 2 Gold, 6 Silver and 5 Bronze.

The Australian Science Olympiad (ASO) program provides students throughout the nation with opportunities to enhance their scientific knowledge, understanding and skills. Selection began last year when 3 879 Year 11 students across Australia were nominated by their teachers to sit the Australian Science Olympiads National Qualifying Examinations in Physics, Chemistry and Biology. 70 of these students went on to be ASO Scholars and attended a residential training school in Canberra. The teams were selected after completing a final exam in March.

As Dr Colin Taylor, Executive Director Australian Science Innovations, explained, we're relying on these science heroes to create our nation's future: "Their results rank amongst Australia's best. All Australians can be proud of our Science Olympians – they matched it with the best of the best in teenage science and returned victorious."

Congratulations to the following students who gained an award:

- **Physics:** 14th/82 countries

37th International Physics Olympiad

1 Gold Medal – Alex Zhang (James Ruse Ag HS, NSW); 1 Silver Medal – Jack Chen (Brisbane State HS, QLD); 3 Bronze Medals – Lucy Pfeiffer (Box Hill HS, VIC), Jordan Brell (Smith's Hill HS, NSW) & Albert Yin (James Ruse Ag HS, NSW).

- **Chemistry:** 20th/66 countries

38th International Chemistry Olympiad

2 Silver Medals – Ying Yueng Chan (Sydney Tech HS, NSW) & Mike Frazis (Sydney Grammar, NSW); 2 Bronze Medals – Michael Fahey (The Armidale School, NSW) & Kartik Ramesh (Sydney Grammar, NSW).

- **Biology:** 6th/48 countries

17th International Biology Olympiad

1 Gold Medal – Amanda Huen (James Ruse Ag HS, NSW); 3 Silver Medals – Christopher Loo (University High, VIC), Dominic Balasuriya (James Ruse Ag HS, NSW) & Yu-Tian Fang (Lauriston Girls School, VIC).

* * * * *

Enquiries: ph 6125 9645, www.aso.edu.au □

WIN A FAMILY PASS TO SYDNEY WILDLIFE WORLD

Sydney Wildlife World at Darling Harbour is a great NEW science excursion venue, opening in September. It will display Australian fauna and flora in 9 different habitats. With over 6000 animals, this will link well to the syllabus. Details: *www.sydneywildlifeworld.com.au*

Sydney Wildlife World

* * * * *

TO WIN A FAMILY PASS TO SYDNEY WILDLIFE WORLD
(for 2 adults & 2 children worth $68) … send in your name, school, & home address on an envelope by **29 September 2006** to: *Sydney Wildlife World Teacher Offer, PO Box 442, Harbord NSW 2096*

Science on the Web

Some relevant websites for studying about desertification issues in Australia

Salinity – our silent disaster
www.abc.net.au/science/slab/salinity/default. htm

Australia is facing an environmental problem that could, and probably will, ruin our economy if it is not dealt with more effectively. Dryland salinity, the gradual loss of farm and grazing land to rising salt, is a massive problem in Australia. There are vast amounts of salt, mostly located underground, that have built up over many thousands of years, originating from the weathering of rock minerals or the simple act of sea salt dropping via rain or wind. When European farming practices arrived and replaced the native vegetation with shallow-rooted crops and pastures, the inevitable happened. With every fall of rain, unused water 'leaks' down to the water table, raising it, and bringing the salt up with it.

Land management in Australia
www.deh.gov.au/land/index.html

This site has articles and website links on most aspects on looking after the environment: forest policy, indigenous land management, native vegetation, natural resource management, parks and protected areas, sustainable land management, threatened species and ecological communities, national land and water resources audit, policies and legislation, biodiversity, water quality, fire-wood.

It has an excellent section on 'Pressures on the land' which covers salinity and invasive species at: *www.deh.gov.au/land/pressures/index.html*

Landuse systems for managing dryland salinity
http://www.clw.csiro.au/publications/70445.pdf

A great publication from CSIRO on this topic.

National Dryland Salinity Program findings
www.ndsp.gov.au/

Findings from the National Dryland Salinity Program (NDSP) which has been Australia's lead research and development organisation investigating dryland salinity causes, impacts and management options for more than a decade.

Australian Dryland Salinity Assessment 2000
http://audit.deh.gov.au/ANRA/land/docs/national/Salinity_Contents.html

A comprehensive national assessment of dryland salinity and sets the context for tackling Australia's dryland salinity management issues. It includes the extent and impact of the problems, as well as processes, monitoring and management options.

This site includes a great report on the findings for NSW: *http://audit.deh.gov.au/ANRA/land/docs/national/Salinity_NSW.html*

Salinity – the awakening monster from the deep
www.science.org.au/nova/075/075key.htm

This looks at the problem of salinity and how it is making more and more of our land unusable and our water undrinkable.

Monitoring the white death – soil salinity
www.science.org.au/nova/032/032key.htm

This site looks at what soil salinity is caused by and new technology that is being used to help monitor the extent of dryland salinity threatening large areas of Australia's agricultural zone.

We find comfort among those who agree with us – growth among those who don't.

… Frank A Clark

Photo Spot Tintinnids and their 'suit of armour'

Tintinnids are ciliated protozoans that live most commonly in salt water but can also live in freshwater and are found in both open seas and coastal waters. The cilia of Tintinnids are used for locomotion and in some species modified oral cilia are used for predation.

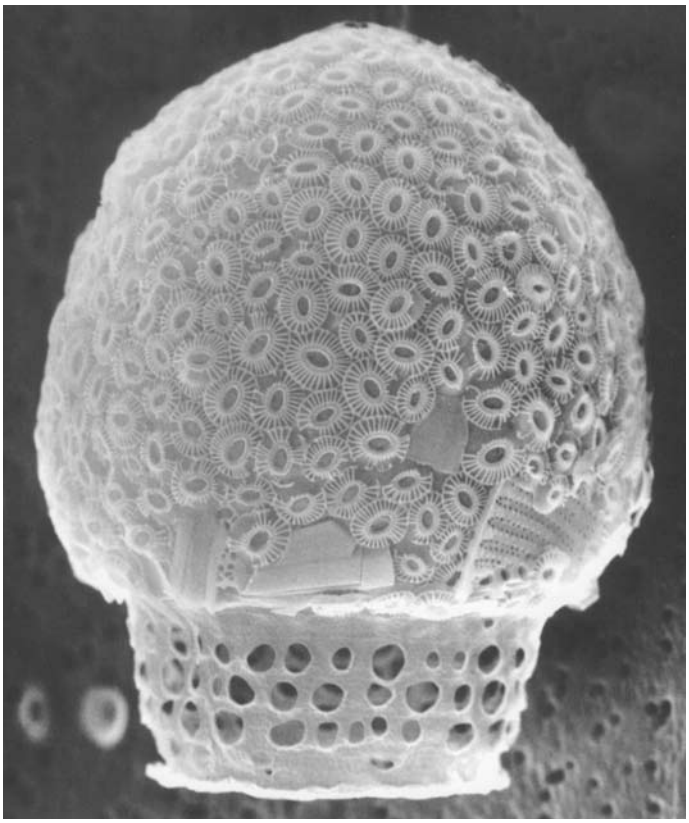
There are between 500–1000 different species of Tintinnids. Each species is characterised by the shape of its external shell (or test) call a lorica – which is either a bowl, vase or tube shape. Tintinnids can withdraw into the lorica.

The lorica is composed of a gelatinous or pseudochitinous secretion. Tintinnids are able to agglutinate (or cement) foreign particles such as silica grains, minute pieces of rock, diatom valves, or coccoliths onto the lorica, and this makes it hard and resistant.

When coccoliths become agglutinated onto the lorica, they give the Tintinnids a peculiar, and beautiful, armoured appearance, just as they do when they are on *Emiliania huxleyi*, the organism which produces these coccoliths (see next section for details on this).

Tintinnids are part of the microzooplankton (i.e. they are animals). They are between 20–640 microns in size, and are usually present in concentrations of about 100 per litre but can reach abundances of several thousand per litre.

Like other members of the microzooplankton, Tintinnids form an important link in aquatic food chains as they are the 'herbivores' of the plankton. They feed primarily on phytoplankton (plant plankton) e.g. photosynthetic algae, as well as bacteria and detritus. In turn, they act as food for larger organisms such as small crustaceans and larval fish.



ABOVE: Lorica of a Tintinnid covered in *Emiliania* coccoliths (scales)

Magnification: 1 100x

This photomicrograph was taken by Harvey Marchant and Gerry Nash, Antarctic Division EM Unit, Hobart. It is used with permission of 'Australian EM Newsletter Calendar'.

Coccoliths and *Emiliania huxleyi*

Emiliania huxleyi is a coccolithophore, i.e. a single-celled algae that is distinguished by special plates (or scales) called coccoliths. Coccoliths are produced inside the cell then extruded to the outside. They are composed of calcium carbonate as the mineral calcite and are the main constituent of chalk deposits such as the white cliffs of Dover. Coccoliths themselves are not living structures but dead mineral structures, analogous to human bone or fingernails, or the shells of oysters and other molluscs. They contribute extensively to the microfossil record because, being hard, they are easily preserved (see Box 1).

The coccoliths from *E. huxleyi* and other algae are either dispersed following death of the algae and breakup of the coccosphere (the outer coccolith casing surrounding the algae), or are shed continually. The coccoliths sink through the water column to form an important part of the deep-sea sediments (depending on the water depth). Thomas Huxley was the first to observe and name coccoliths in sedimentary samples. Hence the species name of *Emiliania* being *huxleyi.*

E. huxleyi is by far the most abundant of the coccolithophores on a global basis, and is extremely widespread, occurring in all except the polar oceans. When water conditions are favourable, it has the capacity to occur in massive blooms, sometimes >100,000 square kilometres (the size of England) in extent. During these blooms, the numbers of *E. huxleyi* cells usually outnumber those of all other species combined, frequently accounting for 80 or 90% or more of the total number of phytoplankton cells in the water. The cells are accompanied by even larger numbers of coccoliths; many of them attached to the cells but also many floating separately in the water.

E. huxleyi is one of 5000 or so different species of phytoplankton – freely drifting, photosynthesising microscopic organisms that live in the upper, sunlit layers of the ocean. Phytoplankton are the oceanic equivalents of terrestrial plants, forming the basis of virtually all marine food webs.

Function of coccoliths

The actual function of coccoliths is uncertain. Hypotheses include defence against grazing by zooplankton or infection by bacteria or viruses; maintenance of buoyancy; release of carbon dioxide for photosynthesis; to filter out harmful UV light; or in deep-dwelling species, to concentrate light for photosynthesis.

Effect of humans on phytoplankton

Coccolithophores are a major contributor to the carbonate accumulating in deep-sea sediments. They influence the global climate system through the organic carbon pump, the carbonate pump and by the emission of dimethyl-sulphide. As the increased CO_2 from fossil fuels, etc diffuses across the sea-surface, the CO_2 acidifies the ocean, lowering its pH. This is causing carbonate concentrations everywhere to fall, as carbon atoms in carbonate molecules move instead into bicarbonate and/or CO_2 molecules, and is hence making it harder for organisms to synthesise their $CaCO_3$ structures. This will also affect the population numbers in turn of Tintinnids, and having less phytoplankton will upset the ecological balance of oceans. □

BOX 1

Evolution of Tintinnids and coccoliths

Although appearing as early as the Ordovician period, Tintinnids became abundant in the fossil record during the Jurassic. Tintinnids are an important part of the fossil record because of the rarity with which most other ciliates become preserved under the conditions of the marine environment. The lorica of a Tintinnid is easily preserved, thus giving Tintinnids an extensive fossil record.

Coccoliths are found in sediments from the Triassic to recent. Because coccoliths are formed of low-Mg calcite, the most stable form of calcium carbonate, they are readily fossilised and so have become important parts of the microfossil record.

Astronomy

Watching the world spin

... Don Whiteman & Robert Garner

The Sun rises in the morning and sets at night and then rises again the next morning. The stars appear to move in circles about a line through the poles of the Earth. By watching stars we can see evidence of the Earth's rotation. Try by looking at the constellation Crux, the Southern Cross – you can watch how its shape rotates over the night. So, how was the Earth's rotation proved?

Aristachus of Samos (3rd century BC) explained the apparent motion of the stars and planets by proposing that the Earth turns on its own axis and also travels around the Sun. Hipparchus and Ptolemy (2nd century AD) rejected this view for two reasons. First, one cannot feel the rotation of the Earth. Second, one cannot (without powerful telescopes) see annual changes in the relative position of the stars. The Earth-centred view dominated European science until the seventeenth century.

Whether or not the Earth rotates was an important question for Christians, as well as cosmologists. Giordano Bruno taught that the Earth moved. He held a range of heretical views and was charged by the Holy Inquisition in Venice. He was sentenced by Pope Clement VIII and burned alive in 1600. Galileo also taught that the Earth moved. He was charged with the same heresy in 1633 but he was spared on condition that he renounced his views. Galileo was forgiven by the Vatican in November 1992.

The observation of Hipparchus and Ptolemy that one cannot feel the rotation of the Earth is correct. However, the rate of rotation required for the heliocentric picture (0.0007 revolutions per minute) is so slow that one would not expect to feel it. How can one measure such a slow rotation?

By 1851 it was well known that the Earth moved: experimental evidence included the aberration of starlight, stellar parallax, and the Earth's measured polar flattening and equatorial bulge. Foucault's pendulum however was the first proof of the rotation of the Earth.

Jean-Bernard-Leon Foucault was a French physicist who was born in Paris in 1819, the son of a publisher. His early education was received at home and he showed promise in mechanics. After obtaining his bachelor of arts degree, Foucault entered medical school but soon abandoned the program. Instead, he began working for Alfred Donne, making preparations for a university medical microscopy course. Then in 1839 he met the French physicist Armand Fizeau and the pair worked closely for almost a decade. Foucault became one of the most versatile experimentalists of all time.

Figure 1: Jean-Bernard-Léon Foucault (1819–1868)

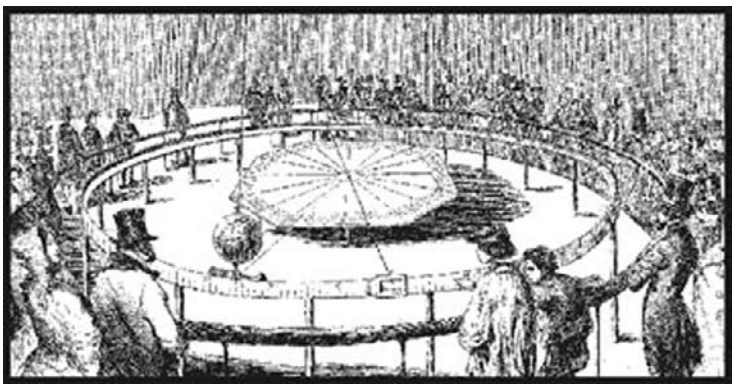


Figure 2:

Illustration of the original Foucault experiment from an 1851 newspaper

Together Foucault and Fizeau took the first detailed pictures of the Sun's surface and developed a more precise way to measure the speed of light in 1849. Foucault proved independently that the speed of light in air is greater than it is in water. His other contributions to the field of optics included a method of measuring the curvature of telescope mirrors, an improved technique to silver astronomical mirrors, a method of testing telescope mirrors for surface defects, and the invention of a polarising prism to orient and manipulate polarised light.

Foucault is most often remembered, however, for proving, with the use of a pendulum, that the Earth rotates on its axis. It was while working with a pendulum to create a clock used for controlling the motion of a telescope that he came upon the idea of using the pendulum for this purpose.

Foucault based his proof on Newton's law, which states that when a body is set in motion, it will move in a straight line from its origin, as long as it is not influenced by outside forces. Foucault demonstrated his proof for the first time at the 1851 World Fair in the Pantheon in Paris. A 28-kilogram iron ball was suspended from the dome of the Panthéon by a steel wire 67 m long and kept in motion mechanically. The plane of its motion, with respect to the Earth, rotated slowly clockwise until it appeared to make one revolution each day. This motion was most easily explained if the Earth turns.

He showed that although the pendulum seemed to change its path during the day, it was actually the floor that was rotating underneath the pendulum. Because the floor is attached to the Earth, it must be the Earth that is rotating.

A Foucault pendulum always rotates clockwise in the Northern Hemisphere with a rate that becomes slower as the Equator is approached. Foucault's original pendulums at Paris rotated clockwise at a rate of more than 11° per hour, or with a period of about 32 hours per complete rotation. The rate of rotation depends on the latitude. At the Equator, 0° latitude, a Foucault pendulum does not rotate. In the Southern Hemisphere, rotation is counter-clockwise.

The rate of rotation of a Foucault pendulum can be stated mathematically as equal to the rate of rotation of the Earth times the sine of the number of degrees of latitude. Because the Earth rotates once a day, or 360° every 24 hours, its rate of rotation may be expressed as 15° per hour, which corresponds to the rate of rotation of a Foucault pendulum at the North or South Pole. At latitude 30° north, for example, at Cairo or New Orleans, a Foucault pendulum would rotate at the rate of 7.5° per hour, as sine 30° is equal to 0.5. The rate of rotation of a Foucault pendulum at any given point is, in fact, numerically equal to the component of the Earth's rate of

Figure 3:

Foucault's pendulum at the Pantheon, Paris

rotation perpendicular to the Earth's surface at that point.

It is interesting to note that the gyroscope was another device invented by Foucault to demonstrate the Earth's movement around its axis. The apparatus he designed is the basis of the modern gyrocompass. Foucault was given the position of physicist of the Paris Observatory beginning in 1855 and was one of the first to demonstrate the existence of eddy currents generated by magnetic fields, which are sometimes referred to as Foucault currents.

Some excellent references on pendulums and Foucault pendulums in particular are:

- *www.phys.unsw.edu.au/PHYSICS_!FOUCAULT_PENDULUM/foucault_pendulum.html* … this also describes the Foucault pendulum at UNSW
- *www.phys-astro.sonoma.edu/people/students/baker/SouthPoleFoucault.html* … this describes a Foucault Pendulum set up at the South Pole
- *www.calacademy.org/products/pendulum/sitemap.htm*

* * * * *

What's coming up in the skies overhead?

Planets

Mercury and Venus will be low in the eastern dawn sky from 10–27 August and will be joined by Saturn around 22–27 August, at which time the three planets will be in close conjunction about half an hour before sunrise.

Jupiter will be in the evening sky all August setting around midnight, but can be located easily on the nights when it is close to the Moon, e.g. around 7 pm on 2 August, and early evening on 29 and 20 August. On 28 August, you will be able to see two of Jupiter's moons, Io and Europa, transit across the face of the planet between 6.30–9.30 pm. By mid-September Jupiter will be setting earlier, by 10 pm.

Box 1 Equinoxes

An equinox is the time of year when the Sun crosses the celestial equator (the projection of the Earth's equator onto the sky) making the length of day and night nearly equal at all latitudes. Day and night are not exactly of equal length at the time of the March and September equinoxes.

The dates on which day and night are each 12 hours occur a few days before and after the equinoxes. This discrepancy is because of the finite size of the Sun and the bending of sunlight by the atmosphere. The specific dates of this occurrence are different for different latitudes.

Note: The day and night will actually be equal on 19 and 20 September 2006 for Sydney and most of NSW; and on 18 September 2006 for the northern parts of NSW.

Mars will be low in the western evening sky, setting around 7.30 pm in August. On 25 August it can be located near the Moon about 45 minutes after sunset.

It is usually difficult to see Mercury due to its closeness to the Sun. However, mid-September on and in October will be a favourable time for viewing Mercury as it will be at its greatest elongation east of the Sun. It will be visible low in the western sky but will be setting about 2 hours after sunset – on 15 and 16 September it will be close to Mars, near the Moon on 24 September, through October it will be near and moving closer to Jupiter, and on 24 October it will be near both the Moon and Jupiter which will be only 1° apart.

Equinox, Crux and Magellanic Clouds

Springtime is almost upon us and the Vernal (Spring) Equinox will occur at 2.03 pm (EST) on 23 September (see Box 1).

The constellation Crux (the Southern Cross) always makes great viewing throughout the year and can be seen all night. It will be on its side in the southern skies with the two pointers (α- and β-Centauri) almost vertically above it in the early evening during August and September. α-Centauri (the pointer closest to the Southern Cross) is a yellow star and β-Centauri is blue.

The Magellanic Clouds will be in a good position for viewing in the early evening night skies at this time of the year. They will be rising higher as the months progress into October and can be found near the South Celestial Pole (see Box 2).

Box 2 Magellanic Clouds

Magellanic Clouds are two galaxies orbiting our Milky Way Galaxy. They are named after Ferdinand Magellan, whose crew discovered them during their first voyage around the world. They share a gaseous envelope and lie about 22° apart in the sky near the southern celestial pole. They are visible to the unaided eye in the Southern Hemisphere but cannot be seen from northern latitudes.

The larger of the two, the Large Magellanic Cloud is more than 150 000 light-years from Earth and is located mostly in the constellation Dorado; the Small Magellanic Cloud is roughly 200 000 light-years away and is almost completely in the constellation Tucana.

Meteor showers

Two sets of meteor showers will be occurring just a couple of days before a new Moon and so should give a good display. The Piscids, a minor meteor shower, will occur during September and peak around 19 or 20 September. The Orionids, which have given a great display over the last few years, should be even better this year and will occur during October, peaking on 21 October (see Box 3 about viewing meteors).

Box 3 Viewing meteors

You don't need a telescope or any special equipment to see a meteor shower, but you do need dark skies. Meteors are best seen when they occur closer to the time of a new Moon. If a full Moon occurs near a shower's maximum period, only the very brightest meteors will be seen. The city lights will cause 'light pollution' which will drown out all but the brightest meteors. A short drive into the country will dramatically increase the number of meteors you see. An unobstructed view is very helpful, so get away from buildings and trees. Try a reclined position so that you are looking almost straight up and can see as much of the sky as possible. You don't want to miss that 'really good' meteor that happens in the part of the sky you can't see. Most meteor showers are better later in the evening – especially after midnight.

Mercury transit of Sun

November is when it starts to really get warm enough to spend many long hours under the night sky, however this year millions of people will be observing during the daytime. On 9 November, in the early morning (between 6.12–11.10 am DST) Mercury will transit the Sun. This is the first time since 2003 and the last time until 2016 that it will be visible from Earth. For anyone living on the eastern coast of Australia we will be able to see the entire event and for those in the west it will have already started by sunrise. Remember to use safe solar observing techniques such as pinhole projection (to make a pinhole camera go to: *www.exploratorium.edu/eclipse/how.html*) or view it at an observatory.

* * * * *

Get out your Sky Charts now and enjoy watching it all spin around overhead. Remember, a good pair of binoculars will help you to see even more.

Note:

- You can download free sky charts from: *http://skymaps.com/downloads.html*
- There is a planisphere to print and use at: *http://members.ozemail.com.au/~starrylady/Planis1.htm*

WARNING: It is dangerous to look directly at the Sun, especially through binoculars or telescopes. SERIOUS EYE DAMAGE MAY RESULT. You should view the transit safely at an observatory using the correct type of solar filter to ensure safe viewing of this event.

The harder you work,
the luckier you get.

… Gary Player

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Winner for *SciTalk 2/06*: *Conquering Chemistry (4th Edition)* – HSC ($62.95)& Prelim ($54.95) texts by Roland Smith & the Blackline Masters (HSC/Prelim $81.95 ea) by Deb Smith, published by McGraw-Hill, were won by Dan Robins, Lindisfarne Anglican School.

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- *SciTalk* No. 1–February 2006 … Jan 27
- *SciTalk* No. 2–June 2006 … April 13
- *SciTalk* No. 3–August 2006 … July 3
- *SciTalk* No. 4–November 2006 … Sept 29

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