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See pages 1, 3, & 12
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Book Giveaway, PO Box 442, Harbord 2096

★ ★ ★ Winner for SciTalk 4/03

Congratulations to Maree Harries, Hay War Memorial HS, who won *Physics 1* and *Physics 2* by Michael Andriessen *et al*, donated by Jacaranda (rrp Bk1: \$52.95, Bk 2: \$54.95).

Hands-on science is fantastic fun

just for fun

Be part of the fun as Luna Park Sydney is coming back this April and take your students there for an exciting day of interactive learning.

Our popular excursions provide students with hands-on activities, and cover concepts in

the current Science syllabuses for Years 7–12.

If you have ever been on a Physics is Fun excursion you will know how practical and beneficial the day is, and if you haven't been, the opening of Luna Park Sydney is a great excuse to bring your students for an educational day where they will also enjoy the thrills and exhilaration of fun park rides.

Students whiz through the air, collide with each other, and shoot down slides all in the name of learning about forces, motion, energy, machines, and more.

Science 7–10 and Physics students will have a great time as they grapple first hand with concepts such as gravity, energy conversions, and friction. Extension work on circular motion will help students appreciate the application of physics to everyday situations. Those of you who remember when Luna Park was last open will no doubt recall with fondness the Dodgems and just how teenagers can extract collision and inertia concepts in a fun setting, whilst also seeing how they apply to real-life situations such as negotiating traffic on the roads in the family car.

Senior Science students will investigate the effects of rides on the human body, the design and construction of rides and potential hazards. They will conduct a safety audit and determine what safety measures are needed to protect the human body from injury in such an environment. They can also work out what

must be done if a disaster such as the collapse of a ride occurred.

Number 1 – February 2004

Biology students will investigate the effects of gravity and inertia on living organisms, the role of sense organs when on a ride, the psychological and physiological aspects of stress,

and the environmental impacts of a fun park.

Fun park rides are a fantastic way to demonstrate physics principles and science and technology to your students in a relevant and interesting way – something they could never experience in the classroom.

Other school faculties can also bring their students to Luna Park and save money by booking their fun day through us. Many teachers use these days as picnic days or rewards at the end of a school term.

It has been eight years since teachers and their students have enjoyed these fun days in Coney Island, or experienced the 'roller-coaster' physics of the Wild Mouse. Very few, if any, of your students would ever have been to Luna Park and so they will approach this excursion with new eyes and enthusiasm.

Another reason we are now inviting you to Luna Park Sydney is that Wonderland Sydney recently announced it was closing in April and while it hopes to keep functioning until then, there is real concern that many of the rides may not be operating every day. We are therefore not offering any more excursions to Wonderland Sydney.

Bookings are now being taken for Terms Two, Three and Four for Luna Park Sydney. Come and be part of the fun at this harbourside venue, and let your students enjoy one of Sydney's icons.



EDUCATIONAL WORKSHEETS & FUN DAYS are available for primary & secondary students

Secondary: Junior Science, Physics, Biology, Senior Science, Design & Technology **Primary**: Science & Technology, English, Mathematics

Save \$\$\$... special DISCOUNT SCHOOL PRICES: see page 6

INSIDE SGITALK >>>>

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Senior Science Luna Park Excursion 1, 6

Science Tests for the School Certificate... 7, 8

)ates

2004

MARCH

Clean Up Australia Day. Ph: 1800 024 890. Details: www.cleanup.com.au Seaweek 2004. Theme: Discover me in the sea. Ideas/activities http://www.mesa.edu.au/seaweek. 11 Mar-3 Apr Shell Questacon Science Circus Tour - Yass, Dubbo, Parkes, Orange, Mudgee, Scone, Bathurst, Lithgow, Katoomba. \$4/student (GST free). Details/bookings: www.questacon.edu.au World Water Day. Theme: Water & Disasters. Details: www.worldwaterday.org/ 27

Astronomy Open Night & Lecture ~20 telescopes operating, displays, sales. Macq Uni (E7B). 6–10 pm. No need to book. \$8 Ad \$4 Ch \$20 Fam. (02) 9850 7111. http://www.physics.mq.edu.au/astronomy/cal.html

APRIL

• 22 Earth Day. Enquiries and suggested activities: www.earthday.net/events/

MAY

4, 7 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107

• 14 Closing date: Eureka Schools Prize (Lateral Thinking Competition). See page 4. 27 Australian Science Challenge. Cost: \$3.85 (incl GST) per student. For further details or an entry form: ph (02) 6125 9645, fax (02) 6125 9646, email: challenge@rtaso.org.au

JUNE

• 2, 4 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107

5 World Environment Day. Details: www.unep.org/wed/

7 - 18Science Teachers' Workshop on HSC Physics Syllabus: Syd Uni. Details on page 5. • /-18 • 18 / 19

Schools Titration Competition 2004. See page 4 of this SciTalk for details.

• JULY

• 2 Closing date Eureka Prize School entries (for Earth, Environmental and Planetary

Sciences, and for Biological Sciences). Enquiries: www.amonline.net.au/eureka

• 3 Closing date BHP Billiton Science Awards. See page 9 of this SciTalk for details. •

3 HSC Biology Teachers Professional Development Program. See page 12 for details. 30 Closing date Olympiad National Qualifying Exams. Details: www.rtaso.org.au/

AUGUST

3-5Science in the City – for secondary schools, Ph (02) 9320 6389, www.scienceinthecity.net • 10–12 Science in the City – for primary schools. Ph (02) 9320 6389, www.scienceinthecity.net

• 14-22 National Science Week 2004. Enquiries: http://scienceweek.info.au/ 16, 20 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107

18, 19, 20 Australian Science Festival - school events. Canberra. Ph: (02) 6205 0588, www.asflimited.com.au

• 25 Physics Olympiad National Qualifying Exam. Closing date: 30 July. (02) 6125 9645

SEPTEMBER

• 1 Biology Olympiad National Qualifying Exam. Closing date: 30 July. (02) 6125 9645

14, 17, 20 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107

26 - 30CONASTA 53: ACT. Ph (02) 6281 6624, fax (02) 6285 1336, www.conlog.com.au/CONASTA53/

OCTOBER

• 18 Oct-13 Nov Shell Questacon Science Circus Tour - Hay, Deniliquin, Mildura, Wilcannia, Broken Hill, Swan Hill, Echuca/Moama. \$4/student (GST free). Details/bookings: www.questacon.edu.au

18 HSC examinations commence

20 Chemistry Olympiad National Qualifying Exam. Closing date: 30 July. (02) 6125 9645

22, 25, 26, 27 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107

23 Astronomy Open Night & Lecture. (02) 9850 7111. http://www.physics.mq.edu.au/astronomy/cal.html

NOVEMBER

• 1, 2, 3, Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107 • 8_9 School Certificate Tests. 8/11: English / Science. 9/11: Maths / AH,G,C&C 15, 16, 19, 23 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107 • 24, 26, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107

DECEMBER

1, 2, 3, 6, 7 Physics is Fun at Luna Park Sydney. Enquiries: ph/fax (02) 9939 6107 Ocean Care Day

JANUARY 2004 National Youth Science Forum. Forms to local Rotary club by 15/5/04, interviews in July. For Year 11 students in 2004 only. Enquiries: (02) 6125 2777, fax (02) 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.

★ The Ultimate Survival Kit for Year 10 ★

- Success in School Certificate English ... by B & S Pattinson (\$10.95)
- New School Certificate Mathematics (2nd ed) ... by Sami El Hosri (\$35.95)
- Science Tests for the School Certificate ... by Catherine Odlum et al (\$32.95)
- Success in School Certificate Australian History, Geography, Civics & Citizenship ... by B & S Pattinson (\$14.95)

SAVE \$\$\$ & make sure your Year 10 students do not miss out!

 $\star \diamond \star \diamond \star$

ENQUIRIES/ORDERS: ODLUM & GARNER PH/FAX: (02) 9939 6107, PO BOX 442, HARBORD 2096. EMAIL: robertgarner@mac.co



Update on BOS matters

Implementation Support for 7-10 Syllabuses

You can discover when these meetings are on in each region at http://www.boardofstudies. nsw.edu.au/aa_main/syllabus_meetings.html Bookings can be made online.

The meetings aim to assist teachers to identify key features of the new Years 7-10 syllabuses; make effective use of BOS support materials, including the Assessment for Learning in a Standards-Referenced Framework: Syllabus Support Materials CD-ROM; use Draft Descriptions of Levels of Achievement; integrate Information and Communication Technologies; understand Life Skills outcomes and content; and clarify School Certificate requirements.

Years 7-10 Science

The new amended 7-10 Science Syllabus, on the BOS website, is to be implemented with Years 7 & 9 in 2005, & Years 8 & 10 in 2006.

BOS website

Teachers and students should go to the BOS website for the latest information and syllabuses - www.boardofstudies.nsw.edu.au

BOS enquiries

Ph (02) 9367 8111, fax (02) 9367 8484.

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Fun Park Excursions



BOOK NOW for Terms 2, 3 & 4 as Luna Park Sydney opens APRIL

* \ \ \ \

A great way to learn SCIENCE and have FUN at the same time (see page 6).

Worksheets are available for: • Primary Science & Technology • Junior Science 7–10 • Physics, Senior Science, Biology • Design & Technology Book your date now by phone or fax on (02) 9939 6107 with Physics is Fun.

· > > > > > > > > > > > > > > > > > OUT AND ABOUT



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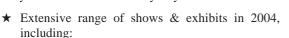
Cost: Single program \$7 pp. Double program \$15 pp.

Enquiries: Phone: (02) 9385 1522. Fax/phone: (02) 9385 1747 Email: j.horder@unsw.edu.au http://hallofhealth.med.unsw.edu.au

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 www.uow.edu.au/science_centre

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2004 features a great line-up of science films, on topics ranging from biology, to space science and the environment.

★ New films include:

TERM 1: *Coral Reef Adventure* – looks coral reefs and their marine life, and how forest clearing and siltation impact on reefs.

Solarmax: A close-up look at the Sun and our relationship to it over thousands of years.

TERM 2: *Roar: Lions of the Kalahari* – An insight into the natural behaviour of lions and their prey as they attempt to survive.

TERM 3: *Ocean Wonderland 3D* – looks at the diversity of marine life on coral reefs, and threats to reef ecosystems.

★ IMAX Classics available in 2004:

Space Station 3D (an ideal double film partner with Solarmax); The Human Body; Bugs 3D; Australia: Land Beyond Time; Antarctica.

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Sydney's IMAX Theatre, at Darling Harbour, is open every day. More than 8 storeys high, IMAX has the world's biggest cinema screen designed 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 which link individual films directly to school programs are provided for school visits.

* \ \ \ \ \ \ \

TO WIN A FREE FAMILY PASS* TO IMAX: (for 2 adults and 2 children) worth \$44 (for a 2D movie) or \$49 (for a 3D movie) ... send in your name, school, home address and home phone number on an envelope by 2 April 2004 to:

IMAX Give Away, PO Box 442, Harbord NSW 2096

* This pass will be valid for any one film for 2 adults & 2 children, for any session, except public holidays and films advertised as 'no free list'.

WINNER: Peter Luke, OTEN won the IMAX Sydney family pass for *SciTalk No. 4–2003*.



RACI SCHOOLS TITRATION COMPETITION

State Competition - Metro Sydney: 18 or 19 June 2004, Regional venues: dates TBA

The Schools Titration Competition is a quantitative analytical competition open to NSW students in years 11 or 12. It operates at a number of venues, and is organised by the Chemical Education Group of the Royal Australian Chemical Institute (RACI).

Students compete in teams of three and, in 90 minutes, must complete a set of acidbase titrations to determine the unknown concentration of a weak acid.

The team's score will depend on the accuracy of the work of its members. The best score wins trophies for the team. They may then be invited to participate in the National Competition later in the year.

This competition is run throughout Sydney and at various NSW regional centres. Entry costs \$21/team (GST exempt).

Depending on their team's results, students may receive a Certificate of Excellence or Merit or Participation.

The de Miklouho-Maclay Prize for Practical Chemistry (a certificate

THE CHEMICAL EARTH

CHEMISTRY

2000 & BEYONE

HUMAN

DISEASE

and cash prize) will be awarded to the student with the best overall results.

Go to www.nswtitration.com for more information/entry forms, or contact Alasdair Hey by email: ajhey@nswtitration.com, ph/ fax (02) 9601 1021, or post: POB 282 Georges Hall 2198. The closing date is 30 April 2004.

2003 Chemical Analysis Competition results: In 2003 approx 950 students entered. Winning teams in the NSW Schools Competition were: Equal 1st-Girraween HS, Shore & Alstonville HS, 2nd-James Ruse, 3rd-St Leo's College.

2003 National Competition results: Of the top 25 scores, NSW achieved 13th place (Shore), 16th place (Barker), 22nd place (Willyama

High) and 24th place (James Ruse Ag High). The de Miklouho-Maclay Prize was awarded to William Wong, Fort St High.

Congratulations to these competitors!

ABC EDUCATION – SCHOOLS

GPO 9994, Sydney 2001

Ph: (02) 8333 4437/4487 Fax: (02) 8333 3055 Website: www.abc.net.au/schoolstv

Secondary Science Programs

Various ABC Schools Television programs are broadcast weekdays between 10.20 am-12 noon. Program details, schedule dates and times are on the ABC Schools Television website.

2004 Secondary Science Programs on in February–June include:

- Salinity: Australia's Silent Flood*
- Photonics The Revolution in Communications
- World Environmental Changes
- Hazards, Disasters & Survival
- Scientific Eye
- WaterWorks*
- Science Bank*
- Inside out
- Living Australia
- Our Earth*

(* Teacher's resource materials available for these)

Chemistry 2000 & Beyond

CHEMISTRY

CHEMISTRY

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by Carolyn Landers

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Each volume contains text, exercises, assignments and practical activities, plus an extensive list of websites, and has an accompanying Teachers' Manual which contains answers to the questions in the texts, resources and a teaching program.

SPECIAL

DISCOUNT

Cost*: Vol 1 & 2 - \$27.50 ea, Vol 3 & 4 - \$32.50 ea. Teachers' Manuals - \$15 ea. (* Prices include postage.)

 $\star \diamond \star \diamond \star$

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CHEMISTRY 10 & BEYOND



Human Disease



A great resource for Stage 6 Biology Core 9.4 AND Stages 4–5 Core section 5.8.4(b), which covers a wide range of diseases of humans, with in-depth studies of many of them. The major areas covered are the different types of pathogenic organisms, protection and immunity,

infectious diseases, and non-infectious disease. There are 17 practical exercises suitable for use in years 7-12.

Human Disease (4th Ed) by Sakker, Odlum & Garner is available FOR ONLY \$16.00 (incl postage) (rrp: \$17.95). Further discounts for bulk orders.



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Odlum & Garner books are produced by Science teachers for Science teachers and their students.



SCIENCE EVENTS 2004 AT SYDNEY UNIVERSITY

Feb 29: Science Transition Workshop for new students*

Mar 24: Sydney Science Forum 1*

April 2: Career Adviser and Teachers' Day#

April 7: Sydney Science Forum 2* April 14, 15, 16: Gifted and Talented

Discovery Program 1*

April 14 & 16: Degree In A Day#

May 19: Sydney Science Forum 3*

June: Olympiad Training Begins*

June: Careers Advisors' & Science

Teachers' Breakfast*

July 14, 15, 16: Gifted & Talented Discovery Program 2*.

Aug 3–5: Science in the City–High Schools§ **Aug 10–12**: Science in the City–Primary Schools§

August 15: Science in the City – Open Day§ Aug: Sleek Geek Week (Sydney & Orange)*

Aug: Annual Physics Competition. Ph 9351 3201 Aug 28: Courses & Careers Day#

Sept 15: Sydney Science Forum 4*

Oct 12: Postgraduate Information Sessions* Oct: Sydney Science Forum 6*

> * Enquiries: ph 9351 5268 # Enquiries: ph 1300 36 2006 § Enquiries: ph 9320 6233

HSC statistics: Entries for science courses and options at the 2003 HSC

The total number of entries for the HSC Science courses* in 2003 was 36 569 and the total number of HSC entries for the 2003 HSC was 64 781. So science entries were 56.5% of the total entries.

In 2002, there were 36 178 science entries, which were 55.8% of the total entries. In 2001, there were 36 372 entries in HSC science courses which represented 58% of the total HSC entries. The numbers in science courses were 40 010 in 2000, 41 249 in 1999, and 40 462 in 1998.

The percentage of science entries has not varied greatly since 1998, but is still much lower than the peak of 54 414 in 1992 which was 90.8% of the total candidature that year#.

The pattern of options presented at the 2003 HSC for each Science course is given as a percentage in the following tables.

Biology				
Total 2003 candidature	12 257 (ở 4 211	9 8 046)		
Q28. Communication		52.1%		
Q29. Biotechnology		5.9%		
Q30. Genetics: The Code Broken?		23.8%		
Q31. The Human Story		18.1%		
Q32. Biochemistry		0.1%		
		100.0%		

Physics					
Total 2003 candidature 9 546 (\$\sigma 7 030)	Q2 516)				
Q28. Geophysics	1.1%				
Q29. Medical Physics	24.3%				
Q30. Astrophysics	24.9%				
Q31. From Quanta to Quarks	46.1%				
Q32. The Age of Silicon	3.6%				
	100.0%				

When you point your finger at someone else, you are pointing the other three fingers at yourself.

... Anon

- * These are the total number of entries in science courses, and not the actual number of students who study a science course, since a fair percentage actually study 2 courses in the same year, and some students since Pathways do 3 science courses.
- # The total number of entries prior to 1996 was based on the total English candidature. Since then, due to Pathways, the total figure each year is still based on English entries, but is slightly affected by acceleration students, Pathways students, etc.
- § The total number of students below reflects the actual number of students who received a result for each subject. It differs from the figures given in the media as their figures are the number of HSC entries for each subject as of September 2003. There is usually a difference between these two sets of figures because some students have illness/misadventure and so do not sit for the examination.

[Note: Individual option percentages are rounded to the nearest 0.1%, thus totals are not exactly 100.0% for some courses.]

Chemistry				
Total 2003 candidature 9 348 (♂ 4 960 ♀ 4 388)				
Q28. Industrial Chemistry	32.3%			
Q29. Shipwrecks, Corrosion and Conservation	50.1%			
Q30. The Biochemistry of Movement	2.3%			
Q31. The Chemistry of Art	4.1%			
Q32. Forensic Chemistry	11.1%			
	99.9%			

Earth & Environmental Science				
Total 2003 candidature 1 212 (♂ 645 ♀ 567)				
Q28. Introduced Species & the Australian Environment	69.5%			
Q29. Organic Geology – A Non-renewable Resource	12.2%			
Q30. Mining and the Australian Environment	7.3%			
Q31. Oceanography	10.9%			
	99.9%			

Senior Science					
Total 2003 candidature 4 178 (♂ 2 451	♀1 727)				
Q28. Polymers	4.1%				
Q29. Preservatives and Additives	7.2%				
Q30. Pharmaceuticals	16.5%				
Q31. Disasters	63.6%				
Q32. Space Science	8.5%				
	99.9%				

Distinction Cosmology: Total 2003 Candidature was 28 (20 males, 8 females). (This course is part of the total science entries.)

These tables were prepared by Robert Garner using data provided by Board of Studies, Feb 2004.



The University of Sydney

I Ith Biennial Science Teachers' Workshop STW2004: The HSC Physics Syllabus – Moving up the Learning Curve

17 and 18 June 2004 at The University of Sydney

These two-day workshops, run by the School of Physics and Science Foundation for Physics, will again look at the newer areas of the HSC Physics syllabus. Lectures and hands-on sessions will cover content and provide practical ideas and resources that will be of use in the classroom. Registration will cover lunch, refreshments, the conference dinner, the session write-ups, and a copy of the book of the lectures given at the 2003 International Science School.

The Workshop will be held at The University of Sydney on 17 and 18 June, and will cost \$275 (incl GST) for two days, or \$220 (incl GST) for one day. Up to two regional workshops will be held.

See www.physics.usyd.edu.au/stw2004 for details and registration forms from late March, or contact:

Dr Jenny Nicholls
Executive Officer
Science Foundation for Physics
School of Physics A28, University of Sydney NSW 2006
Phone: 02 9351 3622 Fax: 02 9351 7726
Email: scifound@physics.usyd.edu.au

PhoTo Spot

Data Tracks on the Surface of a CD

Images and article are by Tony Romeo Electron Microscope Unit, The University of Sydney

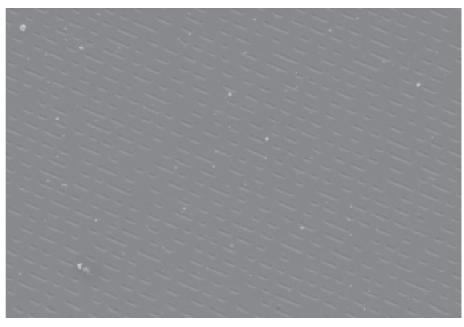
CD technology has changed the way we listen to, record and store music in recent times

In many ways it is similar to the old records that a lot of us (OK – some of us) grew up with, but instead of using a stylus to 'read' the information laid out in a microgroove pressed into the record surface, the CD uses laser light to optically read a pattern of 'pits' and 'lands'.

The 'pits' and 'lands' are stamped into a blank polycarbonate CD surface in a spiral from the centre of the disk outwards ... if this spiral was stretched out in one straight line it would extend for over six kilometres!

A thin layer of aluminium is then deposited over this to help reflect the laser light and finally a layer of lacquer is added to protect the surface from scratches and dust (which is almost inevitable once the CD comes out into the 'real world', and as can be seen by the small white spots on the CD's surface in these photos).

When a laser light is directed at the disc it reflects from the lands and is diffused by the pits and it is this variation in intensities that contains the information that is 'read' and allows us to listen to our favourite music. Contrary to popular belief, the pits and lands do not themselves equate to the 1's and 0's



SEM photograph of the data tracks on the surface of a CD. The smallest bar is about 1 μm long.

used in the binary code of computers that is used to trigger switches on and off, but rather it is the transition from a string of pits or lands that signals the change from a 1 to a 0, or vice-versa

This image is taken from a CD just after

it has gone through the stamping process, but before it has been lacquered. This allowed us to image the pits (and lands between them) on the surface. For the SEM, the specimen was coated with a gold layer of about 20 nanometres to make it conductive.



FUN PARK EXQURSION

2004 DATES*

Luna Park opens in April. So come in Terms 2, 3 or 4.

Dates are: May 4, 7. June 2, 4. August 16, 20. Sept 14, 17, 20. Oct 22, 25, 26, 27. Nov 1, 2, 3, 15, 16, 19, 23, 24, 66, 30. Dec 1, 2, 3, 6, 7.

*Note: Other school days are available by arrangement.

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LUNA PARK SYDNEY: 11 am-6 pm

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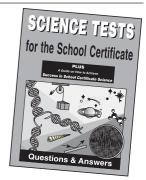
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Food additives

Introduction

People often think of food additives as harmful and unnecessary – they are chemicals and therefore they are automatically harmful. However, 'natural' foods are made of chemicals, so this logic is flawed.

Obviously chemicals that are used as food additives should be fully tested to show that they are harmless before being permitted. The question then arises as to what are food additives. They can be thought of as something added to a food that is not intrinsically part of the food. This definition is easy to use in foods such as milk, fruit and meat, where the product marketed is in a form similar to that produced. In more processed foods this definition is not so easy and what is an 'essential' part of the food or an 'ingredient' and what is an 'additive' needs to known.

Some 'natural' chemicals are harmful

Many people assume that if it is 'natural' it is 'OK'. But this is not always the case.

Many 'natural' products are also poisons. For example, in 400 BC, Greek mercenaries became intoxicated and unconscious after eating honey which had been produced from pollen collected from rhododendrons. The pollen contained a poison which was transferred to the honey. In 1598, members of a polar expedition became extremely ill after eating bear's liver which contained high concentrations of vitamin A which is toxic to our bodies in large doses. Garlic is fatal in high doses, and the fatal dose of nutmeg is about two whole nuts.

Why have additives?

In a 'perfect' society there would be no need for additives as we would all eat fresh foods. However this is not the case, and food additives have been used by humans for centuries. Salt, sugar and vinegar were among the first and were used to preserve foods. Ethylene was used to ripen bananas in ancient China. Wines from Gaul were artificially coloured and flavoured back around 23–79 AD. Spices have been used as antioxidants when no refrigeration was available. Unintentional use of additives has also occurred, e.g. almond icing used on fruit cakes for its flavour in fact contains benzaldehyde which reacts with oxygen in the air to form benzoic acid which is a known and permitted preservative and so the cake was preserved by the 'icing'.

In the past 30 years, however, with the advent of processed foods, there has been a massive explosion in the chemical adulteration of foods with additives. Additives are needed to keep the appearance of food from changing. For example, additives such as carboxymethyl cellulose ensure that icecream remains creamy even after a few days of storage and does not turn into a solid iceblock, sodium nitrite gives bacon its characteristic pink colour and prevents the growth of harmful bacteria such as *Clostridium botulinum* in it.

Foods today are often produced a long way from their point of consumption. Food additives are needed to prevent the loss of food quality. Losses of foodstuffs between farm and table, due to microbiological deterioration, are very high and even in modern countries such as Australia the high incidence of food poisoning indicates the extent of this threat. The incidence of food poisoning would be much greater without preservatives.

Problems with food additives

Considerable controversy has been associated with the potential problems and possible benefits of food additives. Most food additives are considered safe. However, some are known to be carcinogenic or toxic. Hyperactivity in children, allergies, asthma, and migraines are often associated with adverse reactions to food additives.

Permitted additives

Since 1987 Australia has had an approved system of labelling for additives in packaged foods. Each food additive has to be named or numbered. The numbers are the same as in Europe, but without the prefix 'E'.

The permitted list of additives is published as The Food Standards Code. Some additives are strictly controlled and only permitted in a few foods while others are allowed in a wide range of foods and in more liberal amounts. The major groups of food additives are preservatives, colourings, flavourings, antioxidants, artificial sweeteners and their bases, vitamins and minerals, modifying agents such as vegetable gums, mineral salts, food acids, emulsifiers, humectants and thickeners.

There are regulations and procedures that must be followed before a substance can be classified as a permitted additive. Additives are allowed in food only after they have been fully tested, shown to be safe, and placed on the official listing (permitted list) of the foods in which they are allowed. The testing is rigorous and the cost of the research to show that an additive is safe must be borne by the additive manufacturer.

Research to show the additive is safe must include tests in which animals are given the additive, mixed with their diet, but at much higher concentrations than will occur in human food. The tests are designed to give information on any possible effects from short-term or long-term exposure to the proposed additive, including whether it may have any potential to cause cancer, or to affect reproductive processes or the development of the embryo or the foetus if consumed by a pregnant woman. Tests are also carried out to assess its ability to interfere with genetic material in the body, which could lead to the development of cancer or adverse effects in future generations.

The results of the safety tests are assessed by independent experts - independent, that is, of the additive manufacturer or the food manufacturer - and used to calculate the Acceptable Daily Intake (ADI) for humans. The ADI is defined as: 'an estimate of the amount of the food additive, expressed on a body weight basis, that can be ingested daily over a lifetime without appreciable health risk' and is expressed on a milligram per kilogram body weight per day basis (mg/kg w/day). The ADI concept is used extensively by regulatory bodies throughout the world, such as the US Food and Drugs Administration (FDA), the World Health Organisation (WHO) and the European Community (EC) to confirm that ingestion of all additives remains within safe levels. It applies to people of all ages, children as well as adults.

Despite all the care taken there is still controversy over the use of additives – partly because animals are used in such trials, and also because it difficult to take into account the individual differences in intake of various food substances by people.

So we are often left with the question over whether a chemical is considered safe or not, and who will affect or not?

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[Sources: 'Food Additives' by Anne Molloy, Lab Talk Oct 1995 and the websites: http://www.faia.org.uk/choice.php, http://www.x-sitez.com/allergy/additives/index.html]

Science on the Web

Some interesting websites to visit:

• 'The Mind'

http://www.bbc.co.uk/science/humanbody/mind/ At this BBC site you can find out more about how the mind works and try different tests to see how your own mind works.

• Academy's Nova: Science in the News www.science.org.au/nova/

New topics are added regularly, about 78 topics now - with information, glossary, activities, further readings, web links, etc. Some of the latest topics include: 'Stem cells - gateway to 21st century medicine', 'Nanoscience – working small, thinking big', 'Salinity - the awakening monster from the deep', 'Coral bleaching - will global warming kill the reefs', 'Synchrotrons – making the light fantastic', plus many more.

Science Updates

Lemmings' myth finally understood

Scientists decades ago debunked the myth that lemmings commit mass suicide when their numbers grow too large. After 15 years of research with collared lemmings in Greenland, they have discovered that the combined actions of four predator species snowy owls, long-tailed skuas (a type of seabird), arctic foxes and stoats - create the four-year cycles during which lemming populations explode and then nearly disappear. They found that when lemming populations increased, the foxes, skuas and owls began to eat them in a much greater quantity thus causing their population size to shrink rapidly.

[Sydney Morning Herald 3/11/03]

Think twice before you next eat flake

Australia is home to more than 300 species of sharks and rays (the Elasmobranches). Virtually all species pose absolutely NO threat to humans at all, yet we indiscriminately kill millions of them each year. Elasmobranches are now in serious decline around the world.

• The Particle Adventure

http://particleadventure.org/particleadventure/ Discover about the fundamentals of force and matter - this is an interactive tour about quarks, neutrinos, antimatter, extra dimensions, dark matter, accelerators, and particle detectors. It is informative and worth visiting, but allow time as it is slow to navigate.

• Music acoustics from UNSW

http://www.phys.unsw.edu.au/music/

Physics and music have been closely related for thousands of years. This site presents, in musician-friendly format, some of the basics as well as research work in music acoustics. Great site if you are teaching about the physics of sound or just for your general knowledge.

Please note ... any links to an organisation, service or product do not indicate a recommendation or endorsement for them. The above websites were active at the time of printing, so apologies in advance for any changes to URLs.

Several Australian species are listed as threatened and many others are of conservation concern. Commercial and recreational fishing are by far their greatest known killers.

[Australian Marine Conservation Society Poster]

Shrinking Antarctica

Australian scientists have found that the Antarctic coast is shrinking markedly - that more than 500 000 km², or about one-fifth of the region, which was once solid ice is now open water.

[Sydney Morning Herald 14/11/03]

Largest animal ever known

Blue whales (Balaenoptera musculus) are the largest animals known, either living or extinct. Two species are known to exist in southern hemisphere waters. Blue whales are bluishgrey, mottled with whitish spots and have white undersides. Females calve every 2-3 years, newborns are 6 m long at birth and have a 12 month gestation. They are sexually mature between 5-10 years. Adult males grow to about 25 m and females up to 30 m.

6 BHP BILLITON

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 $\star \diamond \star \diamond \star$

ENQUIRIES: http://scienceawards.bhpbilliton.com **BHP Billiton Science Awards**



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2003 BHP Billiton Science Award Winners STUDENT AWARDS

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Kaitlyn Preece (Lyneham High, ACT), 'The prevalence of Toxoplasma Gondii Oocysts in primary school sandpits'.

• Chemistry and Biochemistry

Aimee Williams, Woolooware High, NSW, 'Analysis of ethanol in petrol by gas chromatography'.

• Environmental and Earth Science

Andrew Stewart, Karabar Dist Ed Ctre. NSW, 'Nutrient Runoff – How can swamp plants improve our water?'

• Physics, Engineering and Technology Kaitlin McGinnis, St Mary's Anglican Girls School, WA, 'Orthokeratology'.

SCHOOL AWARD

2004 BHP School of the Year Award Lyneham High School, ACT.

TEACHER AWARDS

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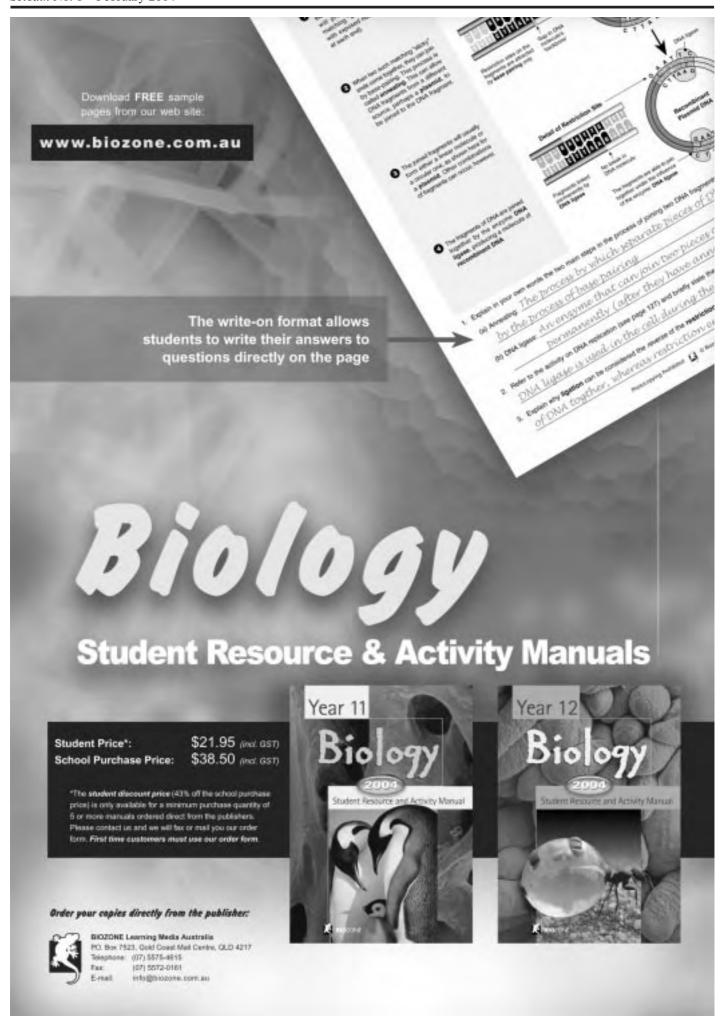
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(See page 7 of this SciTalk for further details)

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The Moon from Suburbia!

The study of lunar surface features and topography (selenography) can be undertaken by anyone with binoculars or even the most basic of telescopes and a Moon map. With the Moon operating on such a regular and short cycle, we can observe it any month and on most nights of each cycle.

For the beginning astronomer, the Moon is a great starting point for observations. It is easy to find and keep in view.

Naked eye observations of the Moon

As a naked eye object, the Moon appears as irregular patches of grey and white. The pattern of grey and white has often been referred to as the 'Man in the Moon' by Europeans, although to some Aboriginals it is a 'boomerang' and to American Indians it is a 'rabbit'. When looking at the Moon from Australia, note that we see the 'Man in the Moon' standing upside down.

The Moon's surface is covered with craters formed by asteroid impacts. The white or bright areas are ancient crust that make up the highlands. The grey or dark areas are newer regions of lava plains that formed from volcanic action in the distant past after asteroid impacts.

Early viewers of the Moon thought the grey areas were water. Some of the names, e.g. Oceanus (*Latin: ocean*), Mare (*L: sea*), Sinus (*L: bay*) and Palus (*L: marsh or swamp*), reflect this.

Mare Crisium (Sea of Crisis) which forms the right eye of the 'Man in the Moon', Mare Serenitatis (Sea of Serenity) to its right and near the centre, and Mare Tranquillitatus (Sea of Tranquillity) just above Mare Serenitatis, are easily identified as naked eye objects, as well as many of the larger craters.

A good Moon map such as the one in the *National Geographic Atlas* will help you to identify the Moon's features (remember to turn it upside down as we see the Moon with its south pole at the top and its north pole at the bottom in Australia). A simple naked eye printable Moon map is at http://www.space.com/spacewatch/moon_guide-1.html

Magnified viewing of the Moon

By 1609, Galileo had made an improved telescope based on an earlier one he had obtained from inventors in Flanders. It was about 30×. His observations of both the Moon and the Moons of Jupiter marked the beginning of modern observational astronomy and the end of the geocentric view of the solar system. Galileo observed that 'the Moon is like the face of Earth itself' marked with mountains and valleys. A pair of binoculars will allow you to see the same view that Galileo saw almost 400 years ago.

The best time to view the Moon with a telescope or binoculars is not at full Moon when

the Moon's whole disc is visible, but rather at the crescent or quarter stages when the low slanting angle of the Sun causes increased contrast between the dark valleys and crater floors and the bright crater rims and mountain ranges. The view obtained is always slightly different because the angle of reflected sunlight from the Moon is a once in a lifetime event as it takes 128 years to hit exactly the same angle again. Along the terminator (the dividing line between dark and light regions of the Moon), craters stand out in sharp contrast. Nearer to the Moon's poles, viewing is quite good through the various phases as contrast remains high.

Some areas of the Moon to look for

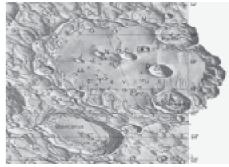
At the centre of the Moon's disc is **Sinus Medii** (*L. Middle Sea*). Directly above Sinus Medii are three prominent features:

- **Ptolemaeus** (named after Ptolemy) is the largest at 150 km diameter. The ridges around it are as high as 2 400 metres, which is taller than Mt Kosciuszko! Ptolemaeus is a large walled plain with many pits on the floor. The crater Ammonius (9 km) lies in this plain.
- **Alphonsus** is a ringed mountain about 90 km in diameter just above Ptolemaeus. It reaches 3200 metres in height. The massif in the centre is about 10 km in diameter.
- Albategnius, another ringed mountain, is adjacent to the left. It reaches 4 400 metres in altitude. Albategnius is 136 km diameter with Crater Klein (44 km) on its right side edge. Some very small craters, under 2 km in diameter, are visible near to the base of the massif. These make a great challenge for suburban viewing.

Moving to the South Pole of the Moon, which found at the top of the Moon's disc, the magnificent **crater Clavius** can be seen. It is 60°S of the lunar equator (that is 60° above to us) and slightly west (that is to the right for us) of the mid-line of the near side of the Moon.

Clavius was named after Christopher Clavius who was partly responsible for our current calendar and system of leap years (see box below)

Clavius is 225 km in diameter. It has two large craters which we see near its left side. The larger crater, Porter (52 km across), is named in honour of Russell W Porter, the American architect who was instrumental in the design of the Hale Telescope at Mt Palomar. Rutherfurd (48 km across) is the slightly smaller crater just above Porter. It is named after Lewis Rutherfurd,



Clavius Crater – this is a Northern Hemisphere view, so invert this image to view Clavius from Australia.

the American astronomer who pioneered photography of the Sun and Moon. A chain of smaller craters form an arc inside Clavius. At less than a kilometre in diameter, they are a test of resolution for backyard telescopes.

During the coming months you will be able to enjoy **Saturn** in the sky for nearly the entire night. **Jupiter** will come into opposition on the 3rd March. The best of this gas giant is yet to come. Basic small refractors of 70 mm and bigger will show the Equatorial Belts as thin darker bands across the middle of the planet. Larger telescopes 200 mm and bigger may be able to spot the Great Red Spot.

Don't forget that on 8 June we will be spectators to a Transit of Venus across the Sun's disc. This rare event will be observable in daytime. It seldom happens in people's lifetimes. The last Transit of Venus occurred in 1882. A transit will not occur again until 6 June 2012 and 11 Dec 2117. The significance of this event is even more important for Australia as it was on the return journey from observing the 1769 Transit in Papeete that James Cook discovered the east coast of Australia. Try to catch this event at one of the big observatories that will be set up for this event. Remember looking at the Sun is very dangerous and the observatories are the safest places to do this as they have the correct types of solar filters to ensure safe viewing of this magnificent spectacular.

Until next time, get into your backyards and really discover the Moon.

... Robert Garner and Don Whiteman

★ CONGRATULATIONS ★

The two winners for *SciTalk No. 4–2004* were Andrew Millar, St Gregory's College Campbelltown & Susan Cooper, OLSH. Both have received a copy of the book:

ASTRONOMY 2004 A PRACTICAL GUIDE TO THE NIGHT SKY

by Glenn Dawes, Peter Northfield, and Ken Wallace

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Clavius, the Gregorian calendar, and leap years

Christopher Clavius SJ was Professor of Mathematics at the Collegio Romano. As a mathematician, he introduced the use of the decimal point. He was a friend of Galileo and keen astronomer. He was largely responsible for the Gregorian calendar which replaced the Julian calendar.

The Julian leap-year rule created 3 leap years too many in every period of 385 years. As a result, the actual occurrence of equinoxes and solstices slowly moved away from their calendar dates. The date of the spring equinox determines the date of Easter so the church pressed for reform.

Clavius proposed that Wednesday 4 October 1582 (Julian) be followed by Thursday 15 October 1582 (Gregorian). He then proposed that leap years only occur in years exactly divisible by four, except that years ending in 00 must be divisible by 400 to be leap years. This rule was the basis of the Gregorian Calendar which is still used today and is so accurate that no further reform of the calendar will be necessary for many centuries.

The people of Frankfurt rioted against the Pope and mathematicians who, they believed, had conspired together to rob them of 11 days. Clavius wrote Novi calendarii romani apologia (1595) which justified the new calendar reforms defending them against these attacks.

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QUIZ QUESTION: What astronomical event occurs in June this year, that no living person has ever seen?

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HOW TO ENTER: Send an answer to the Quiz Question, your name, school, address, and home ph. no. on the back of an envelope to: Competition Corner, PO Box 442 Harbord NSW 2096 ... by 2 April 2004.

Answer for SciTalk 4/03: Precipitate.

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- SciTalk No. 2–May 2004 ... April 16
- SciTalk No. 3-August 2004 ... July 2
- SciTalk No. 4-October 2004 ... Sept 24

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