Providing support and promoting excellence in science education

SciTalk

ISSN 1323-7667

Number 4 – October 2005

Book Giveaway

You could WIN these books ...

Surfing - senior topic books for all Preliminary & HSC BIOLOGY topics

Kerri Humphreys

RRP: $16.95 each

All the **Biology Preliminary & HSC** topics are covered in Science Press' *Surfing* series. Each of the 8 books contains a full summary of all the mandatory syllabus sections, plus some detailed sections. They are great for obtaining an initial understanding of each topic, as well as for revision. Exam-style questions (MC, short/structured/free response) & answers, plus a topic test are provided. The questions cover all aspects of a topic, & are good for exam practice. Marking guidelines are supplied where appropriate.

TO WIN: Send in your name, address, ph. no. & school on the back of an envelope

by 22 December 2005 to

Book Giveaway, PO Box 442, Harbord 2096

Winner for *SciTalk 3/05*

Congratulations to Josephine Cali, Marian College who won the 8 books in *Spotlight Surfing series for Preliminary & HSC Chemistry* ($16.95 ea) by Shell, Molyneux & Hogan, donated by Science Press.

★★ ATTENTION ★★

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

☐ 1. .....
☐ 2. .....
☐ 3. .....
☐ 4. .....
☐ 5. .....

Please return to file or noticeboard.

PRIZES TO WIN!

See pages 1, 3, 11 & 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

Sandy beaches and sharks help to create environmental awareness

Teaching science today is not just about facts and experiments. It is about creating a desire in our students to live in a sustainable way. It is about creating an awareness of the world around us and developing correct values and attitudes towards the environment.

Our students must learn to acknowledge that it is not the 'other person's responsibility', but rather the 'individual's responsibility' to conserve, protect and maintain the environment for the future. They must also learn that our use of resources must be carefully monitored so that we do not harm our environment or affect the survival of organisms in it (Stage 4/5 Science Syllabus: 4/5.10, 5.11, 4/5.27).

Teaching about sandy beaches is a great way to raise student awareness in these areas. Many people do not realise that beaches are not just sand, but living ecosystems. The social, cultural and economic importance of sandy beaches is unquestioned, yet it is often not appreciated that they provide habitat for numerous plant and animal species that are rarely noticed. Thus beaches are far from being ecological deserts. They also have functional ecological linkages with adjacent ecosystems such as sand dunes, the surf zone, estuaries and coastal lagoons. Thus ecologically sustainable management of beaches and all neighbouring ecosystems is essential. There are many relevant articles on the internet for a topic on beaches. An great article to read on this is at *www.mccn.org.au/article.php/id/475/*

Teaching about sharks also helps to raise environmental awareness. Like whales and dolphins, sharks live long, mature late in life, have long pregnancies and most species produce very few young. The combination of these characteristics makes sharks vulnerable to fishing. Most sharks are at the top of their food chain and play an important role in keeping marine ecosystems healthy. Many Australian shark species are now a conservation concern. Some good articles on sharks are at: *www.mccn.org.au/national_newsletter.php* in *Waves Volume 10 Nos. 3 and 4.* ☐

INSIDE SCITALK ▶▶▶▶

Diary Dates

2005 – Einstein International Year of Physics

NOVEMBER 2005

1, 4, 14, 15, 18 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

7, 8 School Certificate Tests – 7/11: English / Science. 8/11: Maths / AH,G,C&C

22, 23, 25, 28, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

DECEMBER 2005

1, 2, 6, 7 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

16 HSC results released

★✧★✧★

JANUARY 2006 National Youth Science Forum. Enquiries: 6125 2777. www.nysf.edu.au/

MARCH 2006

various dates Shell Questacon Science Circus: Armidale, Casino, Coonabarabran, Glen Innes, Gunnedah, Inverell, Moree, Narrabri, Tamworth, Walgett, Wee Waa. www.questacon.edu.au/html/on_the_road.html

3 Schools' Clean Up Australia Day. Ph: 1800 024 890. Details. www.cleanup.com.au

5–12 Seaweek 2006: Footprints for our future. Resources: www.ausmepa.org.au http://www.mesa.edu.au/seaweek2006/ *& News at*: http://www.marineteachers.org.au/

17, 20 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

20 International Earth Day. www.earthsite.org/ [Note: This day is celebrated on 22 April in some places: http://www.earthday.net/]

APRIL 2006

3 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

MAY 2006

9, 10 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

tba Science at the Shine Dome. Australian Academy of Science. Applications for awards for teachers to attend this symposium in by: tba. Details soon at: www.science.org.au

JUNE 2006

2, 5, 7, 9 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

16 Closing date Crystal Growing Comp. www.chem.unsw.edu.au/raci/crystal_grow/index

tba RACI Nyholm Lectures. Details soon at: www.chem.unsw.edu.au/raci

JULY 2006

9–13 CONASTA 55: Science + Education: Inventing the Future. SA. www.sapmea.asn.au/conasta55/

13–16 International Science School: Yr 11 & 12 students, Uni of Syd. Details on page 4

23–29 National Chemistry Week. http://www.raci.org.au/national/events/chemistryweek.html

27 National Chemistry Quiz. www.raci.org.au/national/events/nationalchemistryquiz.html

AUGUST 2006

4 Jeans for Genes Day. Enquiries: CMRI, 1800 677 260, http://www.jeans4genes.com.au/

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

tba Physics Olympiad Nat'l Qualifying Exam. www.aso.edu.au Close date: ? July. 6125 9645

tba Biology Olympiad Nat'l Qualifying Exam. www.aso.edu.au Close date: ? July. 6125 9645

SEPTEMBER 2006

7 National Threatened Species Day. www.deh.gov.au/biodiversity/threatened/ts-day/index.html & www.deh.gov.au/biodiversity/threatened/information/

tba Chemistry Olympiad Nat'l Qualifying Exam. www.aso.edu.au Close date: ? July. 6125 9645

13, 14 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

OCTOBER 2006

8–14 Earth Science Week 2006. http://www.earthsciweek.org/

20, 23, 24 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

25, 30, 31 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

NOVEMBER 2006

3, 13, 14, 17, 21 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

22, 24, 27, 29, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

DECEMBER 2006

1, 5, 6 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

JANUARY 2007 National Youth Science Forum. Forms to local Rotary club by 15/5/06, interviews in 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.

BOARD OF STUDIES

Update on BOS matters

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

SC Science Syllabus implementation 2006
All Years 7–10 will be working from the new revised Science 7–10 Syllabus in 2006.

Health and safety issues in the development and selection of student projects, etc (*BOS 17/05*)
This contains guidelines to ensure the safety of teachers regarding student projects and whether they can be safely accepted for marking by teachers or not.

Information and Communications Technologies (ICT) & where they fit into Revised syllabuses – *are on BOS website*
ICT statements are in a separate document for each subject on the BOS website. Click on ICT Skills, then Science, and you can download the Science 7–10 *ICT Skills List*.

Things to note on BOS website:

- **HSC Notes from HSC Marking Centre** (including **Marking 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*

OUT AND ABOUT

SCIENCE IN FOCUS AT IMAX

IMAX THEATRE SYDNEY

31 Wheat Rd, Darling Harbour, Sydney 2000

★ **NEW FILM:**

Magnificent Desolation: Walking on the Moon 3D

The IMAX space legacy continues with *MAGNIFICENT DESOLATION: Walking On The Moon 3D*, which will take your students to the surface of the Moon to walk alongside the extraordinary Apollo astronauts who stepped upon its surface. With never before seen photographs, computer renditions of the lunar landscape and previously unreleased NASA footage, you will be immersed in the life-changing experiences of these astronauts by showcasing what they saw, heard, felt, thought and did whilst on the lunar surface.

MAGNIFICENT DESOLATION WALKING ON THE MOON 3D

★ **Call IMAX Education for bookings & enquiries:**
Ph: (02) 9213 1600 Fax: (02) 9281 3833
Email: sydgroups@imax.com.au

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

WIN A FREE FAMILY PASS TO IMAX

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 $45 (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 22 December 2005** 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: Diane Hills, Endeavour Sport HS, won the IMAX Sydney family pass for *SciTalk No. 3–2005.*

IMAX THEATRE SYDNEY

UNSW Medical Sciences Schools Programs

At Museum of Human Disease & Hall of Health

Interactive programs offer an amazing insight into the nature and progression of disease in its many forms. Opportunities for curriculum-based Biology/Senior Science programs are now available again after a recent relocation of the Museum. 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 Hall of Health Exhibition on digestive system and dietary disorders called *Gutsy Stuff*
- Biology Teachers Professional Dev't Day – scheduled 21 July 2006

★★**NEW LOCATION:** Gr'd floor, Samuels B'lding, UNSW (see map on web)
Cost: Student workshops $8/student (GST exempt) in 2006. Booking essential.
Enquiries: Ph: (02) 9385 1522. Fax/ph: (02) 9385 1747
Email: j.horder@unsw.edu.au http://hallofhealth.med.unsw.edu.au

NERRINGILLAH ECOLOGY CENTRE

Terms I and II are heavily booked for next year. Why has Nerringillah become one of the most sought after overnight venues for fieldwork in NSW?

- Worksheets that cover the points in the latest syllabuses
- Comprehensive Risk Assessment available
- Secure accommodation, no contact with the public while at the centre
- Fully qualified Field Ecologist teaching your group all day
- Department of Education approved
- Great food
- Great fun
- Great value

New bookings for 2006 are being taken. Visit the bookings page of our website for available dates.

Ph: (02) 44 564 397
www.nerringillah.com.au Email: nerringillah@yahoo.com

Note: This business is for sale. Make an offer. This could be your last chance.

SCIENCE CENTRE & PLANETARIUM

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

★ ***NEW for 2005***: Star Trails Outreach Program – 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.
www.uow.edu.au/science_centre

Pests invade our waterways

Water bodies worldwide are being invaded by non-native aquatic species. One of the primary vectors for the transfer of aquatic nuisance species is ballast water.

Ballast water is an essential component of ship operations, providing proper trim, stability, propeller immersion, and maintaining safe levels of hull stresses in various states of loading. As ballast water is adjusted and flushed into the waters of destination ports during loading and unloading, organisms in the water are also released into the local ecosystem. In some cases, organisms are able to survive and flourish in their new habitat, creating problems for native species and ecosystems. Once a species is established in a new area, it is very difficult to manage and nearly impossible to eliminate.

Currently ships use open-ocean exchange for their ballast water management. This requires ballast water from coastal or port areas to be exchanged with ocean water (at least 200 nautical miles offshore and at least 2 000 metres deep). This process can take anywhere from several hours to a few days depending on the vessel type, method of ballast exchange, and volume of the ballast tanks.

The guidelines for this were developed by the United Nations International Maritime Organisation (IMO) – but it is agreed that it is only a 'stop-gap solution'. Ballast water treatment technology is widely viewed as the ultimate solution. To be effective, ballast water treatment technology must be:

- safe (in terms of the ship and its crew)
- environmentally acceptable (not causing more or greater environmental impacts than it solves)
- practicable (compatible with ship design and operations)
- cost effective, and
- biologically effective (removing or killing aquatic organisms and pathogens found in ballast water).

One of the problems in designing such treatment technology is to develop a system that can kill or remove a broad spectrum of organisms while maintaining the high flow rates and large volumes of ballast water that are needed to maintain normal operations on a large vessel and to also work for the smaller volumes with smaller vessels. Any discharge from such a system must be environmentally safe, which is particularly important if chemical treatments are used.

Getting the right people together to organise such a system is also an obstacle, as well as the lack of testing protocols and the diverse range that exists1. Over the past several years, researchers, regulators, equipment vendors and members of the maritime industry have worked to resolve these issues so that the development of ballast water treatment technologies could move forward more quickly.

They are also working on setting international standards that would nominate a maximum allowable concentration for organisms discharged (i.e. 'x' number of zooplankton/litre of ballast water). The International Convention for the Control and Management of Ship Ballast Water and Sediments was adopted by consensus at the IMO in 2004.

Continued international collaborations, coordination efforts, and symposiums will help to take us closer to effective management of ballast water. □

[Adapted from an article by Karen McDowell in Waves Vol 10 No.1]

In life, all good things come hard, but wisdom is the hardest to come by.

… Lucille Ball

REVIEW: audio-visual resources

Silent storm

This film is particularly relevant for the new Stage 4/5 Science Syllabus as it raises issues that are relevant in our society today and will challenge students to think about how political, environmental and ethical issues are dealt with by our government and scientists.

The background to this film is that in the 1950s the Australian government allowed a series of British atomic bomb tests (at Monte Bello Islands (WA), Emu Field (SA) and Maralinga (SA) without knowing what the consequences might be and without informing the public. Students will be able to consider how unscientific and unethical it was to allow this to happen. They will see how radioactive fallout affected those in the area at the time of the tests, and affected many food chains as it contaminated pasture which was then eaten by sheep and cows and so made its way into the food and milk supply and thus into humans.

Silent Storm tells the story of these events and raises issues that are relevant to Australian society today. It does this through the eyes Hedley Marston (chief scientist at CSIRO) who systematically analysed the data to reveal the truth of the atomic tests and proved that strontium 90 was in the milk supply. Marston reveals how the government disputed his findings and tried to cover them up. He describes his startling discovery of stored bone samples that the government took during autopsies at the time without consent to test. This section raises ethical issues about collecting and testing without knowledge or consent for students to consider. All the bones contained strontium 90 – a by-product of nuclear testing that can cause bone cancer and leukemia. Thus questions are raised about the health repercussions for generations of Australians exposed directly or indirectly to strontium 90, and whether there is a safe level of radioactive fallout?

JOINT EXCURSIONS WITH PHYSICS IS FUN AT LUNA PARK SYDNEY PLUS IMAX OR SYDNEY AQUARIUM MAKE A GREAT COMBINATION

You can combine a PHYSICS IS FUN at Luna Park Sydney excursion 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.

• BOOKING DETAILS & WORKSHEETS AVAILABLE

IMAX: *www.imax.com.au/schooltimetables* for details of IMAX films and how to book.
SYDNEY AQUARIUM: *www.sydneyaquarium.com.au* for details and to book your excursion.
PHYSICS IS FUN: *http://homepage.mac.com/robertgarner* for details and how to book.

• COST

*(*All prices include GST which can be claimed back if doing a curriculum-based excursion)*

BOOK & PAY SEPARATELY FOR EACH EXCURSION

IMAX: $8.50* per student. SYDNEY AQUARIUM: $8.80* per student.
PHYSICS IS FUN at Luna Park Sydney: 17* per student on scheduled dates, or $18* per student on non-scheduled dates. Flat booking fee of $16.50*.
Free Teachers: IMAX: 1:10 all student groups. SYDNEY AQUARIUM: 1:8 for Yr 3–12 students.
PHYSICS IS FUN at Luna Park Sydney: 1:15 secondary students / 1:8 primary students.

• PLANNING YOUR DAY

Before / After Luna Park: Allow 1 hr for IMAX *(any film)*; or 2 hrs for a Sydney Aquarium excursion.
11 am–6 pm: Allow 2–3+ hours for Luna Park Sydney visit.

This film links to many parts of the Science 7–10 Syllabus [4/5.1, 4.3, 4/5.4(c)&(e), 5.3, 5.4, 5.5, 4/5.16, 4/5.17, 4/5.23] and will help students to develop their scientific literacy as they form opinions about what happened.

★ ★ ★

Who's Afraid of Designer Babies?

This film will compel students to think about the impact of reproductive technologies on humans, and the ethical and social issues involved in the decision-making processes.

It explains how Australia is at the forefront of a genetic technology that will let us 'design' our offspring. And how pre-implantation genetic diagnosis or PGD allows scientists to screen embryos conceived through IVF. It will make students think about the potential of this technology and who should decide about how to use it?

This compelling documentary follows a couple who are trying to have a child with the right genetic make-up to save their son's life. It presents talks to parents who have used PGD for gender selection and to leading scientists and ethicists from around the world. Going beyond sensationalist media headlines, this fascinating and thought-provoking film presents a wide range of perspectives on a complex and emotionally charged issue.

Senior Biology students will find this film interesting and relevant as they study genetic engineering and reproductive technologies. It is also great for teaching 4/5.4 in the Science 7–10 Syllabus about the implications of Science for society and the environment, social and ethical considerations, and the choices that are involved.

★ ★ ★

Both films are available on either DVD or video from Film Australia, for $84 ea ($77 ea incl GST plus freight). Teachers' notes can be downloaded free from the internet at *www.filmaust.com.au* □

RG

Footprints for our Future: The Choices we make

If you live near the coast, or even if your school is a long way from the sea, learning to live, work and play in a sustainable way will help to protect and preserve many of our precious land and marine environments.

Seaweek 2006 will showcase:

- 101 ways to lighten your eco footprint.
- A poster competition with cash prizes.
- A collaboration of teachers' resources used to teach and facilitate sustainable practices and aligned with a week long program to celebrate each day of Seaweek 2006 with a special theme.
- An online gallery of case studies of students and community using sustainable practices to lighten their footprint.
- PLUS MANY MANY MORE surprises and resources!

Put the dates into your calendar, get your thinking cap on, and become involved in Sustainable Education. If you have any great ideas, activities, work-sheets or contacts, you can share them by contributing to a resource data base being put together by the Marine Education Society of Australasia (MESA). All contributions will be considered and will be acknowledged if used. For details, go to: *http://www.mesa.edu.au/seaweek2006/*

Everyone can celebrate what's being achieved and share in the collective responsibility of lightening our footprint for our future. □

Science on the Web

Recycling in Australia reaching a crisis
www.publish.csiro.au/ecos/index.cfm?paper=EC125p24&sid=11
An article from *ECOS* to download. It describes how we are faring as a nation when it comes to recycling, how we should really be doing more of it, our waste crisis, our demands on resources, and pollution of land, water and air through landfilling and burning waste.

Explore – Einstein Explained
www.abc.net.au/science/explore/einstein/
A collection of stories, quizzes, videos and games from the ABC – all to do with physics to celebrate the year inspired by Einstein.

Einstein Light
www.phys.unsw.edu.au/einsteinlight/
This site uses animations and film clips to explain relativity at a range of levels.

Science Playwiths
http://members.ozemail.com.au/~macinnis/scifun/menu.htm
Everyday science, more complex experiments, methods, enquiries, Australian science and technology (plus inventions) timeline, ideas for science projects etc – from Peter Macinnis.

Starry Nights Planetarium
www.starrynight.com.au
Mobile planetarium based in Brunswick Heads on the far north coast of NSW – will travel between Tweed Heads and Lismore.

How tunes get stuck in your head
http://news.bbc.co.uk/2/hi/health/4332771.stm
Scientists have found that when you can mentally 'hear' a 'catchy' tune that is not playing, there is brain activity in the auditory cortex - which handles information from ears.

Seven great Physics Trivia Quiz sites:

- *www.physics2005.org/events/physicstrivia/questions.pdf*
- *www.funtrivia.com/quizdetails.cfm?quiz=177654*
- *http://ppewww.ph.gla.ac.uk/~wbell/Applets/PhysicsQuestion.html*
- *http://godel.ph.utexas.edu/Members/larry/quiz/quiz.html*
- *www.findtrivia.com/educational/body_educational.html*
- *www.kettering.edu/~sps/trivia.html*
- *www.coasterdynamics.com/CoasterDynamics/Quiz.html*

Cells Alive
http://www.cellsalive.com/
This site will fascinate your students and help them to revise in a fun way with video clips and interactives in cell biology, microbiology, immunology, microscopy, plant & animal cells, mitosis, meiosis, cell cycle, and more.

Nuclear Science in Society
www.ansto.gov.au/edu
Resource for Science 7–10. It explores aspects of nuclear science and technology and will help students to interpret information they encounter. Available in CD-ROM format and online.

★ *A new science magazine* ★

COSMOS is Australia's only popular Science magazine. It is produced monthly by Luna Media Pty Ltd in Sydney.

It is about ideas, science, society, technology, and the future, across topics as diverse as art, design, travel, exploration and archaeology.

Subscribe to *COSMOS* for 1 year for only A$78.75 & receive a free Mars poster!
Offer ends 31 January 2006.
Details: *www.cosmosmagazine.com/*

★ *A FREE e-magazine* ★

Velocity: Science in Motion is a free, quarterly e-magazine from ANSTO.

It features stories on breakthrough Australian science and some of ANSTO's medical, environmental and industrial innovations in nuclear science which are enhancing the lives of millions throughout Australia. It can be subscribed to at: *www.ansto.gov.au/* by clicking on 'subscribe'.

The first man of science was he who looked into a thing, not to learn whether it furnished him with food, or shelter, or weapons, or tools, or playwiths, but who sought to know it for the gratification of knowing.

… Samuel Taylor Coleridge (1772–1834)

Photo Spot — Molybdenum trioxide – an artistic perspective

This electron micrograph shows a bright field transmission electron microscope (TEM) image of a molybdenum trioxide crystal (MoO_3) that has been artistically superimposed with a crystal diffraction pattern of MoO_3 (these are the white dots you can see).

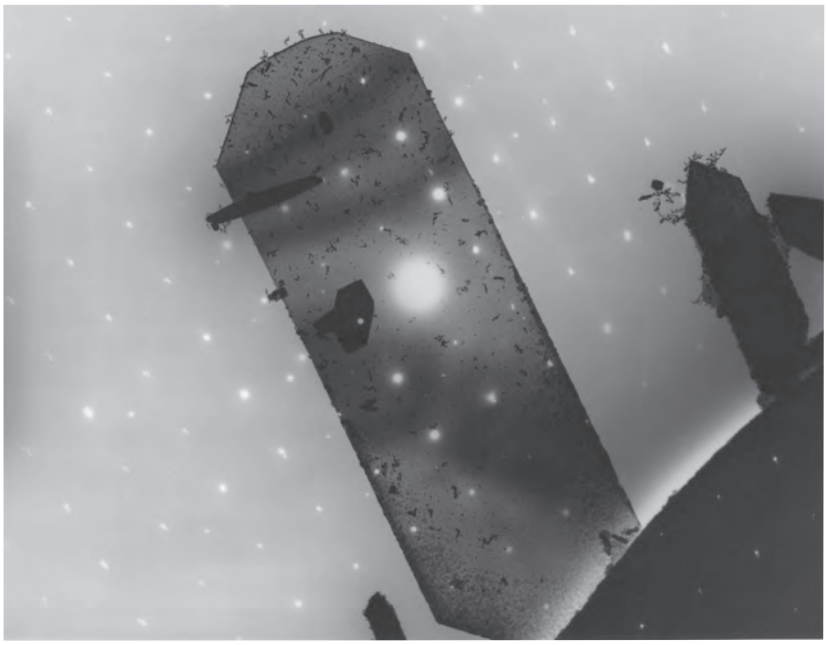
X-ray diffraction is used to produce such crystal diffraction patterns. These are used in the study of crystal structures. Essentially everything we know about the atomic structure of materials is based on results from X-ray and neutron diffraction. X-rays have wavelengths comparable to the distance between atoms. When a crystalline sample is illuminated with X-rays, the X-rays are scattered (diffracted) into very specific directions with various strengths. Detectors are used to measure this 'diffraction pattern', which is then processed by computers to deduce the arrangement of atoms within the crystal.

This technique came from the work of Max von Laue (1912) and Lawrence Bragg (1913). Bragg's method of X-ray crystallography was used until the 1960s, when the capabilities of X-ray crystallography were greatly improved by the incorporation of computer technology. Crystal structures containing 100–200 atoms now can be analysed in just 1–2 days, whereas prior to 1960, a 20-atom structure took 1–2 years for analysis.

The molybdenum trioxide (MoO_3) crystal shown in the image can also be referred to as molybdenum (VI) oxide. MoO_3 is a white to pale yellow, crystalline solid.

MoO_3 contains molybdenum (Mo, atomic no. 42) which never occurs as a free element in nature. The main ore in which it is found is molybdenite (molybdenum sulfide, MoS_2), but it is also occurs in wulfenite ($PbMoO_4$). It is moderately common in the Earth's crust with an abundance of about 1–1.5 parts per million. MoO_3 is formed when the ore, molybdenite, is 'roasted' during the process of extracting the element molybdenum. The major countries that produce it are China, Chile, and the US.

Molybdenum is a hard, silvery white solid that usually occurs as a dark gray or black powder with a metallic lustre. It comes in many forms: foil, sheet, wire, insulated wire, mesh, rod, powder, nano-sized activated powder, and tube. Because of its high melting temperature (2 610°C), molybdenum is used as filament supports in light bulbs, metal-working dies and furnace parts. It improves the strength of steel at high temperatures and so is used as an alloy in stainless steels, alloy steels and in tool steels.



ABOVE: MoO_3 crystal diffraction pattern superimposed over a TEM of a MoO_3 crystal. Photo by David Llewellyn, ANU. Permission to reproduce from Australian EM Newsletter.

Molybdenum compounds have many uses, e.g. in paint pigments, metal finishing, zinc plating, alloys used in aircraft and missiles, in space vehicles, smoke and flame retardants, ceramic glazes, enamels, corrosion inhibitors, as a catalyst in petroleum refining, and in nuclear energy applications. Molybdenum is an essential trace element for nitrogen fixation in plants and so it is used in agriculture as an additive for fertilisers and feeds. Molybdenum disulfide is a good lubricant, especially at high temperatures where normal oils decompose.

Molybdenum was discovered in 1778 by Carl Welhelm Scheele whilst conducting research on molybdenite, a bluish-silver ore, which is often confused with graphite and lead. In fact the name of this ore comes from the Greek word 'molybdos' meaning 'lead'. Scheele concluded that it did not contain lead as was suspected at the time and reported that the mineral contained a new element that he called molybdenum after the mineral ore. Molybdenum metal was first prepared in an impure form in 1782 by Peter Jacob Hjelm. □

Astronomy

Amateur telescope making is alive and well

... Don Whiteman

Telescope making can be as simple as placing two lenses in a tube to make something in the distance appear very close. Telescopes have advanced a long way since the first ones and can be quite large. Despite the advances, amateur telescope makers still exist and successfully make telescopes.

The first telescopes

The idea of a making a telescope is generally credited to the Dutchman Hans Lippershay in October 1608. He used a weak positive lens as the objective and a strong negative lens as the eyepiece. His telescope was so successful that he was commissioned to make three more. They were only used as terrestrial telescopes.

Astronomical observation was revolutionised when the Italian mathematician and physicist, Galileo Galilei (1564–1642), built his own telescope in 1609 and turned it to the heavens (Figure 1). In 1610 Galileo discovered four satellites of Jupiter and that the Milky Way was a sea of faint stars so close together in the sky that the eye could not see them separately. He also discovered, but could not explain, the rings of Saturn. In 1611, he discovered the phases of Venus, sunspots and solar rotation. Modern astronomy was born.

Refracting telescopes were the only type of telescope that was made for over 60 years until the British scientist Sir Isaac Newton designed the first reflector (c1670). A reflecting telescope (reflector) is an optical telescope which uses mirrors to reflect light, rather than lenses to pass light. He designed the reflector in order to overcome the problem of chromatic aberration, a serious problem in all refracting telescopes before the perfection of achromatic lenses. The traditional two-mirrored reflector is known as a Newtonian reflector (Figure 2).

These two types of telescope have been the most common types of telescope made by amateur astronomers ever since.

The size of telescopes increases

For many years telescopes were only made by scientists. This changed in the 20th century as the hobby of astronomy came to the forefront of amateur science. Astronomy was gaining interest amongst the general population who were particularly interested in the 'Big Eye' at Mt Palomar. The construction of this telescope was inspired and begun by George Ellery Hale.

Hale was a man with a mission to get large telescopes built in the US and was able to successfully coerce philanthropists to fund the Yerkes 40" Refractor at Lick Observatory (1897) which remains to this day the largest refractor in the world, the Hooker 100" reflector on Mt Wilson (1917) above Los Angeles, and the 200" Hale Telescope (the 'Big Eye') at Palomar Observatory (1948) (Figures 3–5).

Figure 3 – Yerkes 40″ refractor (1897)

Amateur telescope making & astronomical societies

The amateur telescope making movement however took off as a result of the work of Russell William Porter (1871–1949). Having learned celestial navigation and timekeeping during his time working in the Arctic, Porter was inspired by his astronomical observations in the Arctic to become involved in building amateur telescopes.

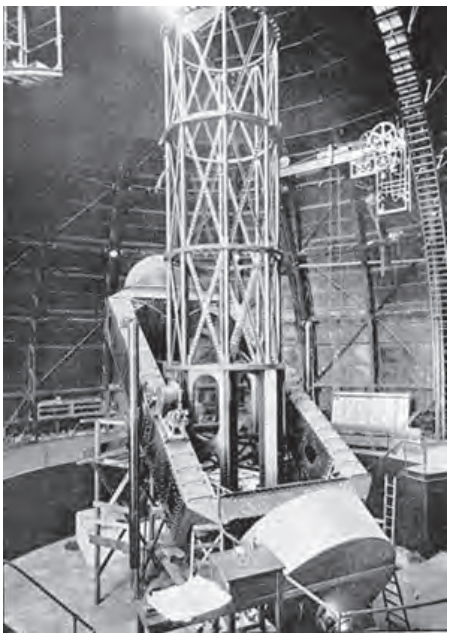


Figure 4 – Hooker 100″ reflector (1917)

Porter had studied architecture at MIT and worked as a cartographer, and this experience combined with his remarkable artistic skills and astronomical skills, led to his being employed by Hale as an artist to do some sketches for the then greatest scientific undertaking of its day, the 200" Hale Telescope at Palomar. He was able to do the most intricate cut away sketches that allowed the builders to envisage how it would look structurally in three dimensions (Figure 6). He spent two decades of his life on this project.

After his trip to the Arctic, Porter began to write astronomical articles in *Scientific American* which led to the formation of astronomical societies and telescope making groups. The first such organisation was the

Figure 1 – Galileo's refracting telescope (1609)

Figure 2 – Newton's reflecting telescope (1670)

Figure 5 – Hale 200″ reflector (1948)

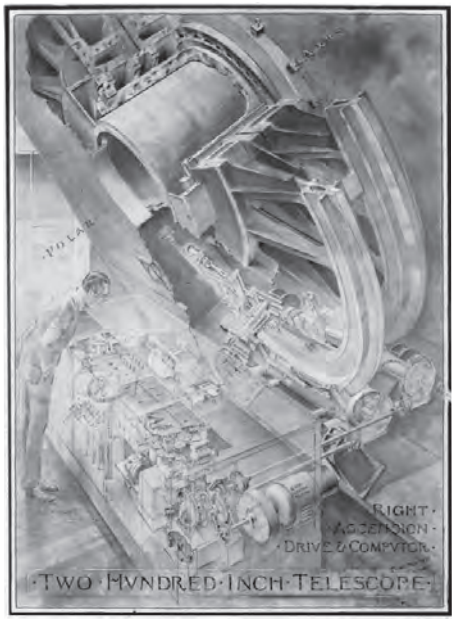


Figure 6 – Porter's cut away sketch of the Hale 200" turret scope

Springfield Telescope Makers in Vermont which was established by Porter in 1923. A group of a dozen or so would meet regularly at a local machine and tool workshop and design and build what for their day were great astronomical instruments, e.g. the Porters Turret Telescope, the Springfield Mount and the Garden Telescopes and Sun Clocks.

In July 1926 the first conference of Amateur Telescope Makers was held at the now famous Stellafane Pink Clubhouse on Breezy Hill to enable amateur telescope makers to gather, show off their creations and teach each other mirror grinding and telescope making techniques.

The annual Stellafane Convention of amateur telescope makers has continued and in August this year held their 70th Anniversary of the Stellafane. The convention has grown from the 2 dozen attendees of 1926 to the 2 500 attendees of 2005. Literally tens of thousands of telescopes have been made by amateur astronomers around the world and many continue to do so. The author was lucky enough to go there this year. Breezy Hill looks today exactly as it did in 1926 and is considered the mecca of amateur telescope makers.

If you want to make a telescope, Stellafane has a website (http://www.stellafane.com/atm/atm_main.htm) with lots of information on making a telescope, and see Box 1. □

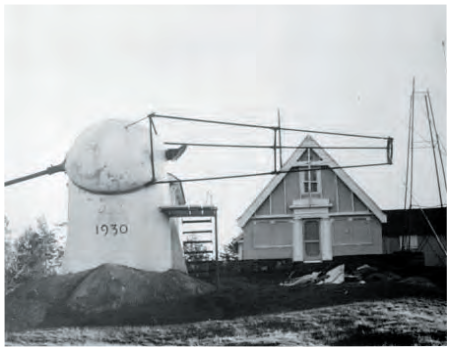


Figure 7 – Breezy Hill looks the same today as it did in 1926

What's coming up in the night sky?

Planets & stars

In November, Sagittarius (the 'Teapot') will be easy to locate as Venus (the brightest object in the night sky) will be in it all month. On 5–6 November, about one hour after sunset, a thin crescent Moon will be near Venus.

Mars will be at opposition on 7 November (although its closest approach was actually on 30 October) and is now moving away from the Earth. It will still be visible in our skies until well into the New Year, however, it will be progressively smaller as each week passes. Best viewing will be 11 pm or later in the north-east above the naked eye cluster Pleiades (the 'Seven Sisters') and Mars will be the brightest object in the sky at this time (as Venus will have already set). On 16 November in the early evening, the full Moon will occult (cover) the Pleiades (see Box 2).

Saturn is returning to the pre-midnight skies and will offer great views over the coming months. December through to February is the time to view Saturn. By the end of the year Saturn will be rising at the end of astronomical twilight around 10 pm. It will reach opposition on 28 January.

Jupiter will be in the eastern pre-dawn skies by the end of November. It will have the new Moon just near it around 28–29 November about one hour before sunrise. Jupiter will return to the night skies rising around midnight in early January.

December will see Venus as bright as it will get for this year at –4.7 magnitude, however it will be heading for the Sun and reaches inferior conjunction in mid January.

BOX 1 Making a telescope

Two websites that are worth visiting if you are interested in building a telescope are:

- www.bintel.com.au/atm.html
- www.telescopes-astronomy.com.au/telescopes002.htm

Meteors

The Taurids which often have colourful fireballs will continue on from October until about 25 November and can be seen from late evening until early morning. Best viewing will be earlier or later in the month as a new Moon occurs 2 November and last quarter is 24 November. In the first two weeks of December you may possibly view the chi-Orionids or the Puppid-Velids meteor showers. This year the Geminids will not be seen due to a full Moon. □

BOX 2 The Pleiades & Subaru logo

The Pleiades is one of the finest open clusters for viewing with binoculars. Also known as the Seven Sisters because of its seven brightest stars and Messier 45, it has a prominent place in ancient mythology (www.ras.ucalgary.ca/~gibson/pleiades/pleiades_myth.html). This white star cluster is about 500 light years from Earth and in the constellation of Taurus.

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In Japan, 'subaru' (meaning 'gathered together') is the name given to the Pleiades. If you examine the insignia logo for Subaru cars (below), you will see a stylised version of the Pleiades (with six of the largest stars) as ancient mythology meets modern industry.

Centenary of E = mc² ★ ★ ★

The Einstein International Year of Physics is drawing to a close. What have you done this year to celebrate the 'Einstein International Year of Physics'? Have you been on a physics excursion yet? If not, see page 7 of this *SciTalk* for details about *Physics is Fun*

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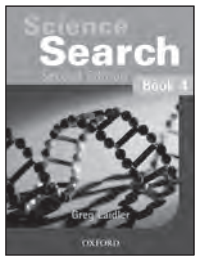
COMPETITION CORNER

Send in an entry NOW to win these books:

Science Search 1–4 (2nd edition)

by Greg Laidler. Published & donated by Oxford University Press



Science Search Books 1–4 were written specifically for the NSW Science 7–10 Syllabus, and have been fully revised for the current syllabus. Each chapter consists of a series of double-page spreads, with each concept developed through a mixture of explanation, experiment and questioning. Questions are graded in difficulty, testing recall, synthesis and analysis. All science processes – observation, hypothesis, experiment and theory – have been included. The contents are structured to suit the academic and developmental growth of students and cater for different learning styles and abilities and teaching techniques.

QUIZ QUESTION: What is the curved upper surface of a liquid in a beaker called?

HOW TO ENTER: Send an answer to the Quiz Question, your name, school, address, & home ph. no. on the back of an envelope to: Competition Corner, PO Box 442 Harbord NSW 2096 – by 22 December 2005.

Winner for *SciTalk 3/05*: The 4 books in *Spotlight Surfing series for Preliminary & HSC Senior Science* ($16.95 ea) by Heffernan, from Science Press, were won by Rebecca Taylor, Girraween HS.

SciTalk 3/05 answer: Surface tension

Biometrics: the butterfly effect

The brilliant design of a Himalayan Butterfly wing inspired two scientists, Maryanne Large and Leon Poladian, at The University of Sydney to spend six years researching the structural colour of butterfly wings.

Structural colour is colour derived from the structure of a substance rather than a pigment, e.g. the blue of the sky. From their theoretical modelling they determined that the crystalline microstructure of the wing's surface would make it iridescent if it could be seen without the structure on top, but the wing pattern was not iridescent at all. One day, Maryanne came up with the idea of removing the scales from the wing surface and immediately it lit up with iridescent reds, oranges and mauves.

Understanding this was important because it gave a better understanding of optical microstructures in nature – and gave them the ideas, insights and inspiration needed for another aspect of their work, which involves engineering new kinds of optical fibre.

Microstructured polymer optical fibre (MPOF) is a new fibre that was invented at the Optic Fibre Technology Centre where these scientists also worked. The MPOF is made of plastic, not glass. It is cheap to manufacture and has many possible applications, such as in astronomy, biosensing, automotive industry, and high speed data transmission to connect computer chips and local area networks.

The surface of a butterfly wing and polymer optical fibres share a common reliance on optical microstructures which control light in some way. Although both projects evolved separately, the scientists say that understanding biological microstructures provided critical insights and inspiration for their technology work.

Innovation inspired by nature is known as biometrics. A classic example of biometrics is the development of velcro, which was inspired by the tiny hooks that caused burrs to cling to animal fur. The biometrics work of these scientists is just another example of how we can 'mine' the diversity of structures that occur in nature. *[The University of Sydney Gazette August 2005]*

SUBSCRIPTIONS … *SciTalk* is available FREE to all secondary science faculties in NSW and the ACT. However, if you would like to receive your OWN personal copy or extra copies of *SciTalk*, subscriptions are available for just $16 per 4 issues. Please send a cheque for $16 + GST = $17.60 (to *SciTalk*), plus your name, address and telephone number … and you will receive the next four issues of *SciTalk*.

SciTalk

SciTalk is a newsletter for secondary Science educators, now is in its 11th year, and is produced quarterly by Odlum & Garner as a service to Science teachers. It is sent FREE-of-charge to all secondary Science faculties in schools and TAFE throughout NSW and the ACT.

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

Please pass *SciTalk* on to all Science teachers at your school so they can benefit from it – or put it up on your notice board for reference.

Contributions, advertising and inserts are welcome.

Copies of *SciTalk* are also available at:
http://homepage.mac.com/robertgarner

CONTRIBUTIONS

SciTalk is due into schools mid-term. All contributions for *SciTalk* should be directed to the Editor (see below).

CLOSING DATES

- *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

ADVERTISING & INSERTS

All enquiries to the *SciTalk* Editor:
Catherine Odlum
PO Box 442, Harbord 2096
(34 Ocean View Rd Harbord 2096)
Ph (02) 9939 6107. Fax (02) 9939 6105
Email: cathie_odlum@mac.com
ABN 54 942 891 924