

SciTalk

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Number 4 – October 2007

Book Giveaway

WIN this book ...

NSW BIOLOGY

by Carolyn Jeffery & Pauline Ross



ISBN:

9781420208894

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Published by Macmillan Education Australia

This text and CD covers the Stage 6 Biology core and options, in the syllabus dot-point progression. It is in a full-colour, wide-page format that will engage and support Year 11 & 12 Biology students. It contains summaries, revision questions, first & second-hand investigations, HSC style questions and sample answers, sample assessment tasks, and skills and data presentation. An accompanying CD contains the text as PDF files and all the HSC options. Also available: Teacher Resource Book + CD (\$99.95).

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Winner for SciTalk 3/07

Congratulations to Amanda Barralle, Narara Valley HS, who won *Dot Point HSC Senior Science & Preliminary Senior Science* (\$39.95 ea) published by Science Press.

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See pages 1, 4 & 12

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

The key to classroom learning and testing: keep it simple!

Scientific research has shown that it is essential to 'keep it simple' if we want students to understand new concepts, and when testing their knowledge and skills.

To effectively engage students in our lessons, and have them learn and retain anything, it is important that we understand how the human brain takes in information, processes it, and then stores it.

When we are presented with new information, it is passed from our sensory memory into our working memory. Working memory is where all conscious thought takes place. Information is processed in working memory and then passed to long term memory, and it can also be recalled to working memory from long term memory.

Whereas long term memory is effectively unlimited in duration and capacity, scientists have shown that working memory is limited in duration to a few seconds unless rehearsal takes place, and limited in capacity to approximately seven elements or 'chunks'. This research has shown that this applies to everyone despite his or her individual differences.

A 'chunk' of information may contain a number of related elements that can be

remembered as if one element, and so chunks enable a greater amount of information to be in working memory. For example, a physicist learns to 'chunk' $v = u + at$ as one idea, and $s = ut + \frac{1}{2}at^2$ as another single idea, and so can take more information into their working memory this way. But every decision we make, still depends on seven brain spots, whether it involves a simple process such as adding $2 + 3$, to whether it involves a complex task such as flying an airplane.

Unless we have a way to 'chunk' information, each new thing is a single element. The size of a 'chunk' depends on how the information in the 'chunk' is organised. The bigger the 'chunk', the deeper our thinking. Here is where the value of practice and studying plays a part – as it enables us to 'chunk' data and so increase the amount of information that we can process. For example, a learner driver has to think about each single thing when making a turn, such as 'turn the wheel to turn right, brake, change the gear, put on the blinker, straighten the steering wheel, accelerate on the straight line of the road', etc, whereas a more experienced driver does all these things 'as if on auto-pilot', without

... continued on page 4

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Diary Dates 2007-08



2007 – International Polar Year (& International Year of the Dolphin)

OCTOBER 2007

- 18 Oct–13 Nov HSC exams (see box on page 5 for timetable for details)
- 19, 22, 26, 29 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

NOVEMBER 2007

- 12–16 School Certificate Tests (see box on page 5 for timetable details)
- 2, 8, 12, 16 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 23, 26, 29, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 27 ESSA Test

DECEMBER 2007

- 6, 7 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 19 HSC results released

2008 – International Year of Planet Earth

- For:** Shell Questacon Science Circus 2008 program: www.questacon.edu.au/html/on_the_road.html
- In mid-2008:** Science Teachers' Workshop 2008 – held by The Science Foundation for Physics & The School of Physics

- JANUARY 2008** National Youth Science Forum. Enquiries: (02) 6125 2777, www.nysf.edu.au/

FEBRUARY 2008

- 29 Schools' Clean Up Australia Day. Ph: 1800 282 329. Details. www.cleanup.com.au

MARCH 2008

- 2–8 Seaweeek 2008: *Extinction – a Saw point*. www.mesa.edu.au/seaweeek2008/default.asp
Some resources also at: www.ausmepa.org.au
- 14, 17, 31 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 20 International Earth Day. www.earthsite.org/
[Note: 20 March is the original day, but it is celebrated on 22 April in some places: www.earthday.net/]

MAY 2008

- 2–4 Science at the Shine Dome, Australian Academy of Science: *Dangerous climate change: is it inevitable?* Details re teacher awards to attend, soon at: www.science.org.au
- 8, 9, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

JUNE 2008

- 2, 6 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- tba Closing date Crystal Growing Comp. www.chem.unsw.edu.au/raci/crystal_grow/index

JULY 2008

- 6–9 CONASTA 57: *Surfing the Wave of Change*. (07) 3861 5444. Fax (07) 3861 5701.
Griffith Uni Gold Coast Campus. www.astmanagement.com.au/conasta57/
- 21–25 National Chemistry Week. www.raci.org.au/national/events/chemistryweek.html
- 24 National Chemistry Quiz. www.raci.org.au/national/events/nationalchemistryquiz.html

AUGUST 2008

- 1 Jeans for Genes Day – helps to fund scientists working at Children's Medical Research Institute. 1800 436 437, <http://www.jeans4genes.com.au/>
- 16–24 Australian Science Festival, ACT. School Activities: dates tba. www.sciencefestival.com.au
- 16–24 National Science Week: *Planet Earth – Planet of Change*. www.scienceweek.info.au/
- 16–24 Australian Science Festival, ACT. School Activities will be at: www.sciencefestival.com.au
- 15, 18, 21 Science Week events: Physics is Fun at Luna Park. <http://homepage.mac.com/robertgarner>
- 20 Physics Olympiad Nat. Qualifying Exam. www.aso.edu.au/ Close date: 27 June. 6125 9645
- 27 Biology Olympiad Nat. Qualifying Exam. www.aso.edu.au/ Close date: 27 June. 6125 9645

SEPTEMBER 2008

- 3 Chemistry Olympiad Nat. Qualifying Exam. www.aso.edu.au/ Closedate: 27 June. 6125 9645
- 11 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 21 Spring equinox

OCTOBER 2008

- 12–18 Earth Science Week. www.ga.gov.au/education/events_6249_9859 (www.earthsciweek.org)
- 17, 20, 24, Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 27, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

NOVEMBER 2008

- 10, 14, 21, 24 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
- 27, 28 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

DECEMBER 2008

- 4, 5, 12 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105

- JANUARY 2009** National Youth Science Forum. Forms to local Rotary club by 15/5/08, interviews in July. Only for Yr 11 in 2008. 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.

Update on BOS matters

Regularly check the BOS website to ensure you have the latest information. It contains syllabuses, past exam papers, Official Notices, Board Bulletins, a statistics archive & more.

Approved scientific calculators for 2007 HSC exams – list updated (BOS 40/07)

This list has been updated again. Make sure your students know which scientific calculators are allowed in the HSC. This list is at: www.boardofstudies.nsw.edu.au/manuals/calculators_hsc.html

Reminder: Periodic table has been updated

The periodic table of elements used by the BOS has been updated, in line with IUPAC recommendations and is on the BOS website in 'HSC Syllabuses'. It would be a good idea to use this version for all your Stage 6 Preliminary/Trial HSC exams in schools.

On BOS website:

- 2006 HSC Marking C'tre 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

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Worksheets are available for:

- Primary Science & Technology, English, Maths
- Science 7-10 • Technology • Mathematics • Art
- Physics • Senior Science • Biology • Photography
- Peer Support • Commerce/Bus. Studies/Tourism

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15, 18 and 21 August 2008

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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, & school address on an envelope by **21 December 2007** to:
 Sydney Aquarium Teacher Offer, PO Box 442, Harbord NSW 2096

WINNER: Judy Warner, Great Lakes College Tuncurry, won the Sydney Aquarium family pass for *SciTalk* No. 3-2007.



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 the ultimate film experience. IMAX films are entertaining and educational. They constantly change and cover a wide range of themes. Quality resource materials & teacher guides are provided for schools.

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

WINNER: Vivienne Gilkes, St Charbels College, won the IMAX Sydney family pass for *SciTalk* No. 3-2007.




WIN A FAMILY PASS TO SYDNEY WILDLIFE WORLD



Sydney Wildlife World at Darling Harbour is a great NEW science excursion venue, which opened in September 2006. It displays Australian fauna and flora in 9 different habitats. With over 6000 animals, this will link well to the syllabus. Details: www.sydneywildlifeworld.com.au

TO WIN A FAMILY PASS TO SYDNEY WILDLIFE WORLD (for 2 adults & 2 children worth \$68)

Send in your name, school, & school address on an envelope by **21 December 2007** to: *Sydney Wildlife World Teacher Offer*
 PO Box 442, Harbord NSW 2096.

WINNER: Rob Jaeger, Albion Park High won a Sydney Wildlife World family pass for *SciTalk* No. 3-2007.



Science Teachers' Forums



CHILDREN'S MEDICAL RESEARCH INSTITUTE

Venue: Children's Medical Research Institute, Westmead, Sydney
When: May and November
Time: 9.45 am–4.30 pm
Content: These one-day Science Teachers' Forums focus on the use of Gene Technology in medical research, concentrating on topics relevant to the HSC Biology syllabus.
Cost: \$55 to cover cost of refreshments and comprehensive lecture notes.

For further information and teachers' forum registration details, contact Jane Fleming on (02) 9687 2800 or email: jfleming@cmri.com.au

Continued from page 1 ...

The key to classroom learning and testing: keep it simple!

having to think about each one individually. Rules and procedures become automated with practice. The same applies in learning. If we know our times tables automatically, then our whole brain space can focus on a mathematics problem and not be decreased by worrying about 5×6 . Automation can improve performance.

Working memory has both a storage function and a processing function – the two functions may compete for memory resources. The 7 element limit is for storage and processing combined. It has also been shown that working memory will hold even less if we are frightened, hot, cold, emotional or distracted as there is even less brain space available for thinking.

If working memory can only hold and use up to seven elements or 'chunks' of information at a time, then children should not be expected to process more than a few elements at a time, either in the classroom or in the exam room.

Many of our current testing strategies now require students to read large amounts of background material, often for no apparent reason other than to answer one or two questions within a series of questions. This style of testing goes well beyond the 7 element limit for our working memory. There are too many distractors that divert students from the tasks they have to complete, e. g. such tests contain a number of 'recall of knowledge' questions in amongst the reading material and the comprehension questions based on this reading material. Although the answering of such recall questions uses long-term memory as well working memory, it still contributes to the overloading of the working memory.

This demand on the working memory makes processing more difficult as it causes it to take much longer to work out what the information is about, as it causes the person to have to go back and forth multiple times between all the elements to sort them, and then to process them all. It can even make processing impossible in many cases, especially if a student is struggling with the English in the reading passages.

Do the ESSA Tests and School Certificate Science Tests really measure a student's ability in Science? Do our strategies in the classroom demand too much of our students? Are our lessons simple enough so that each new concept we are teaching does not exceed the 7 element limit.

Surely we should take note of soundly based research results, and ensure that we apply them in our teaching and testing procedures, whether we like them or not.

Have you ever tried to remember an 8 digit telephone number? People can easily remember 6 or 7 digit telephone numbers, but give them an 8 digit telephone number and they are immediately struggling to remember it. What happens when there is background noise, e.g. loud music or talking? It is more difficult to process information, when noise is taking up part of the working memory, if not directly, then in the effort to shut out the noise. Interestingly, research backs up the concept that learning and understanding will be more effective in a quieter environment.

In the classroom, we must try to present new ideas in their simplest possible form, so that they can be taken into our students' working memories. So the message for our lessons and lesson material is: 'keep it simple'. Do not overload our students' working memory with more than 7 elements at a time, or our lessons will not be effective.

When writing tests for students, present each item clearly and simply. Keep diagrams with the actual question. Do not give them long reading passages that are unnecessary for answering the questions. Do not make a student have to read back and forth from one page to another, and remember lots of data from one page in order to find it again to answer questions on another page. This is an example of split attention. It will make many students just want to give up due to the high cognitive load as they move their eyes to and from one or more diagrams to the text, or from text to text on different pages. It will simply overload their working memory, making processing extremely difficult or impossible. It will not be testing their ability or knowledge in Science. □

Success in Science series:

★ 2 titles NOW AVAILABLE ★

Years 7 & 8 Science Assessment

by Mitch O'Toole

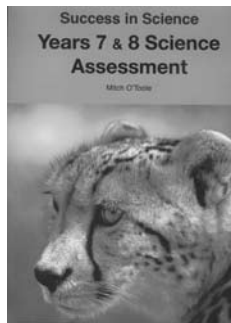
ISBN 978-1-741302-86-8, rrp \$24.95

Published by Five Senses Education

This book has been written to help Year 8 students learn about science and to prepare them for doing tests such as ESSA (Essential Secondary Science Assessment).

It has been designed so that students can use it at home on their own, or with assistance. Full instructions are given (in case students are doing it without a teacher). By working through this book, students will develop some of the techniques needed to answer science test questions, e.g. multiple choice, matching, sequencing, labelling, short answer and extended answer questions.

The book includes TWO Science Assessment Tests that cover the Stage 4 outcomes from the BOS Years 7–10 Science Syllabus. Like ESSA, these two Science Assessments use a stimulus magazine to provide a common context for students who have worked through differing science programs.



Years 9 & 10 Science Summary

by Jeanette Rothapfel & Mitch O'Toole

ISBN 978-1-741302-87-5, rrp \$12.95

Published by Five Senses Education

This book has been written to help Year 9 and 10 students revise and summarise the essential knowledge content of the NSW School Certificate Science course.

Students will do this by using completing cloze passages on the various dot points of the syllabus. The answers are given as completed sentences as "Repetition Reinforces Learning". There are also some practise Multiple Choice questions, plus some work on science investigations.



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"The mind is not a vessel to be filled,
 but a fire to be kindled."

... Plutarch

2007 School Certificate Tests

12 November

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

13 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)

14–17 November (each school on one of these days)

- Computing skills test

2007 HSC Science Examination Dates

24 Oct Chemistry: 9.25 am–12.30 pm

Senior Science: 1.55 pm–5 pm

30 Oct Biology: 9.25 am–12.30 pm

5 Nov Physics: 9.25 am–12.30 pm

6 Nov Earth & Environmental Science:
 1.55–5 pm

2008 should be a year to remember!

There will be a number of International Year themes in 2008 from which to choose. They include:

- International Year of Planet Earth: www.ga.gov.au/about/event/ and www.esfs.org/
- International Year of the Reef: www.iyor.org/
- International Heliophysical Year (March 2007–March 2009): <http://www.ihy2007.org/>
- The International Polar Year (March 2007–March 2009): <http://www.ipy.org/>
- International Year of Sanitation: <http://esa.un.org/iys/>

Scientists change their minds about elephants

It was once thought that only humans, chimpanzees and maybe dolphins had self-awareness, based on the mirror test. With this test, other animals do not recognise the image in a mirror as themselves at all. It is now known that elephants can recognise their own image in a mirror from the results of experiments done at a New York Zoo in late 2006.

The three female elephants were seen to use their reflections to examine inside their mouths, their ears and showed other signs of awareness. They did not react socially to the images, as if they thought they were seeing other elephants. One of elephants, Happy, repeatedly touched a mark painted onto the cheek of her head and which she could see only in the mirror. This mirror test was developed 35 years ago by biologists to assess mirror self-awareness in children and apes and is considered a valid test for this. The elephants also kneeled in front of the mirror and tried to look behind the mirror, which is behaviour associated with self-awareness and determining that the mirror image was just that, an image.

The findings confirmed a long-standing suspicion among scientists that elephants, with their big brains, complex societies and reputation for helping ill herd mates, have a sufficiently developed sense of identity to pass the challenging 'mirror self-recognition test'.

Some scientists have taken a more skeptical view, reflecting the controversy that has long engulfed the field of animal intelligence generally and the meaning of the mirror recognition test in particular. They think that the results are not conclusive as only three elephants were tested, and only one elephant, Happy, passed the 'touching the mark' test.

The researchers have acknowledged that the precise meaning of the test is debatable, but they strongly suspect that the rarity of mirror self-recognition makes the test a good marker for a certain level of consciousness. Whatever the mirror test's real meaning, the fact that few beyond humans can pass it speaks to the need to protect Asian elephants, which are endangered because of hunting and habitat destruction. □



FUN PARK EXCURSIONS

2007 DATES*

Oct 19, 22, 26, 29. Nov 2, 8, 12, 16, 23, 26, 29, 30. Dec 6, 7.

2008 DATES*

March 14, 17, 31. May 8, 9, 30. June 2, 6. Aug 15, 18, 21, 25. Sept 11. Oct 17, 20, 24, 27, 30. Nov 10, 14, 21, 24, 27, 28. Dec 4, 5, 12.

* Note: **ALL OTHER SCHOOL DAYS** (not Tues/Wed) are also available

TIME 11 am–6 pm

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* plus 10% GST (schools can claim this back if doing a curriculum-specific excursion).

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These fun park excursions are presented by experienced teachers.

WORKSHEETS ... secondary / primary

Secondary: Science 7–10, Physics, Biology, Senior Science; Technology; Visual Arts; Maths; Peer Support; Commerce; Business Studies, Tourism; Photography.

Primary: Science & Technology, English, & Mathematics; Art; or Peer Support.

JOINT EXCURSIONS

Save \$\$\$ – see an IMAX film or visit Sydney Aquarium, before or after Luna Park ... see p3.

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Physics is Fun was co-authored in 1983 by Robert Garner and Sylvia Jennings and was based on their earlier excursions at Luna Park in the 1970s. Robert has conducted these fun park excursions since their inception ... both at Luna Park (1983-1987, 1995, 2004-2007) and Wonderland Sydney (1990-2004) – covering many different subject areas. With the closure of Wonderland Sydney in early 2004, these Fun Park Excursions have been at Luna Park Sydney since its re-opening in April 2004.

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

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ENQUIRIES/BOOKINGS

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The astrology myth

There are many different astrology systems. The ancient astrologers were unaware of planets beyond Saturn, and other astronomical bodies such as quasars, so astrology does not consider how these affect us. Each astrology system places emphasis on different astronomical bodies and divides the sky differently.

The basis for astrology is the zodiac. In western astrology there are 12 zodiacal constellations representing the Sun's path. Astrologers make their predictions based on these constellations. Yet the 12 zodiacal signs no longer correspond to the same part of the sky as their original constellations, and the constellation Ophiuchus has not been used, although the Sun also passes through it.

The time taken by the Sun to pass through each of the thirteen constellations varies from 7–44 days, yet the astrologers claim that the Sun spends approximately 30 days in each of their 12 zodiacal constellations.

One reason for the difference between astronomy's zodiac and astrology's zodiac lies in astrology still using coordinates based on a geocentric solar system that Science abandoned 400 years ago. Astrologers have also failed to adjust their dates for changes in the calendars such as from the Julian calendar to the Gregorian calendar, which occurred in different parts of the world at different times.

Yet astrologers claim that the movement of the planets and the Sun through the zodiac can explain and predict events on Earth! Astrology is really 'mythology' – it is not scientific at all.

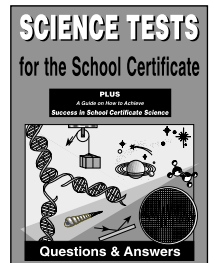
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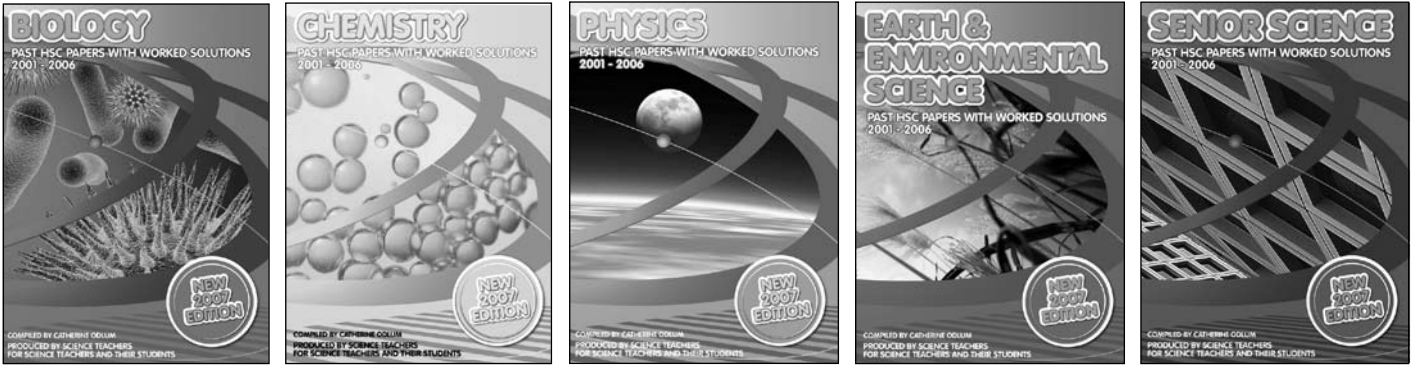
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Looking at the Taurus Constellation, variations in the Moon ... and our Summer skies

... Robert Garner and Catherine Odium

Taurus (Latin: bull) is a constellation that has been associated with the bull for thousands of years

Long ago, the Greeks imagined patterns in the sky to represent animals, objects, etc. In Greek mythology, *Taurus* represents the mythical bull-form taken by Zeus in order to win the Phoenician princess, Europa. Zeus, as the white bull, captured Europa and took her to Crete with Orion the Hunter following, his arrow at the ready.

Looking at the Taurus Constellation

This time of the year is great for observing *Taurus*, especially if away from city lights.

Firstly, locate the *Orion* constellation, which is quite distinctive with its ‘saucerpan’ (the bottom of this is Orion the Hunter’s ‘belt’) – see Figure 1. Remember – Australia is in the Southern Hemisphere, so these constellations are upside down for us compared to how the ancient Greeks saw them.

Then you will find *Taurus* just to the south-west and next to *Orion*, with *Gemini* and *Canis Minor* to the east. These constellations are overhead at this time and are all part of the Milky Way. A star chart/planisphere will make your search for them easier (see Box 1).

Remember to steady your binoculars. When using binoculars (short of buying a binocular mount), the usual way of coping with the shakes, is to observe from a deck chair with arms. By resting your elbows on the arms and the eyepieces against your face, the dancing of the image is greatly reduced.

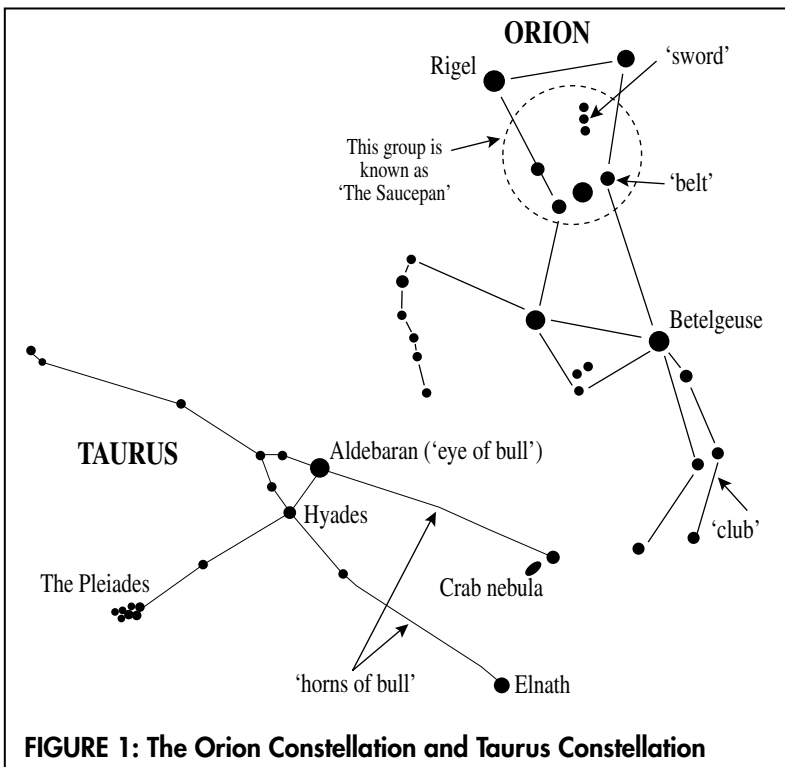
A tour of Taurus

Taurus is one of the brightest constellations with 16 stars above fourth magnitude in brightness.

Look for the V-shaped group of stars in the sky – this represents the Bull’s head, and is actually the **Hyades star cluster**. At the top right of this V-shape is **Aldebaran**, a red giant – it is the brightest star in *Taurus* and 14th brightest star in the sky. It is said to be the red eye of the bull. Aldebaran is not part of Hyades and is 65 light years (ly) away from Earth, while the Hyades star cluster is about 125 ly away. The



Taurus, one of the 12 constellations in the traditional Zodiac signs used by astrologers (see p 6), is depicted in this 16th century medieval woodcut.



Hyades star cluster consists of about 200+ stars. About 100 of these stars can be distinguished with binoculars. It is the closest star cluster to the Earth.

Just to the right of Aldebaran, **Theta (θ) Tauri** is the brightest star in the Hyades. It is actually a **binary star** that consists of a brighter white star and a less bright yellow/orange star. The colour difference is easily discernible with binoculars. **Sigma (σ) Tauri** can be seen just below Aldebaran and is also a **binary star**, consisting of a pair of white stars one a little brighter than the other (magnitudes 5.1 and 4.7).

Now look below and to the left of the Hyades. Here you will see the **Pleiades** (Messier 45, or ‘Seven Sisters’), another famous **star cluster**. Depending on the darkness of the sky, the brightest 6 or 7 stars can be seen with the naked eye and very many more with binoculars. The Pleiades appears brighter than the Hyades because there are more stars closer together. The stars are hot and bluish-white in colour. At a distance of about 420 ly, the Pleiades comprises several hundred stars.

The ‘horns’ of the bull stretch off to the south-east away from Aldebaran and the Hyades. At the furthest end of the top ‘horn’ is the **Crab Nebula** (the remnant of the supernova observed by Chinese and Japanese astronomers, as well as native American observers, in 1054 AD). Unlike the other stars that you have observed in *Taurus*, the Crab Nebula requires a telescope to be seen. The Crab Nebula has a **pulsar** (a rotating star) at the centre of its gas cloud. □

What will be in the skies overhead?

Venus is a ‘morning star’ over Summer, rising 2–3 am in the east. The normal west to east movement of planets against the stellar background can be seen as Venus moves eastward from Leo into Virgo. On 6 December, Venus will be close to the waning Moon.

Mars is rising in the northeast in Gemini just before midnight in October and pass close to the 20-day old Moon on 31 October. In November it will rise a couple of hours after sunset. On 16 November, Mars will appear stationary, then begin a period of retrograde motion (‘appears’ to move backwards) until end of January 2008. In

December it will rise closer to sunset. Its retrograde loop will take it into *Taurus* by the end of December, then back into *Gemini* in early March 2008. Mars will be close to the Full Moon on 23 and 24 December. At present, Earth, on its orbit closer to the Sun, is catching up to Mars in its slower outer orbit. On 25 December, Earth will pass between the Sun and Mars – and Mars will be at opposition. Mars will appear 4× larger than last January.

Jupiter is in the western evening sky in November setting earlier each night. It will be lost in the glare of the Sun in early December.

Saturn will rise around 2 am in Leo in November. On 4 November, the waning

crescent Moon will appear between Saturn in the east and the bright star Regulus to the west. By mid-December Saturn will appear into the late evening sky. Until 20 December, Saturn will move eastward, but then its retrograde movement begins towards the west and it begins to re-approach Regulus.

Meteor showers: *Orionids* are active 2 Oct–7 Nov with a maximum expected on 21 Oct. *Leonids* are active 10–23 Nov with maxima on 18 Nov. *Taurids* are active 1 Oct–25 Nov with maxima on 5 Nov (*Taurids South*) and 12 Nov (*Taurids North*). *Geminids* are active 7–17 Dec with maxima on 14 Dec (if not to low on the horizon for observing). □

Variations in the Moon

Sky watchers have thought for thousands of years that the full Moon looks much bigger as it rises and sets than when it is higher in the sky. This is an optical illusion. Use of a camera to take photos of the Moon when it is just rising and a few hours later when it is higher in the sky will record the same angular diameter in both photos. Perspective plays tricks on the eye.

But are all full Moons the same? Most people would think that all full Moons when high in the sky look the same brightness and size – but they are wrong. Full Moons actually vary in size from one Full Moon to another. This is one of the most spectacular phenomenon in naked-eye astronomy – yet it escapes notice by the vast majority of people simply because the human eye cannot compare observations made at different times.

Variation in the Moon's size and brightness

The Moon's orbit around the Earth is elliptical, with a substantial eccentricity of 5.49%, and its orbit is influenced by the relative positions of the Sun, Earth and Moon. As a result, the distance of the Moon from Earth at apogee (the Moon's furthest position in its orbit to Earth) and perigee (the Moon's closest position in its orbit to Earth) varies with each orbit of the Moon around the Earth.

Extreme values for the perigee and apogee distances occur when the perigee or apogee passage occurs close to New Moons or Full Moons. This year, on 26 October 2007, the full Moon occurs within 6 hours of a perigee and it will be 356 753 km from Earth. The Moon's closest distance to Earth (perigee) within 120 years of the present (4 January 1912) was 356 375 km, while its furthest distance to Earth (apogee) will be 406 720 km (3 Feb 2125). In the Southern Hemisphere, apogee and perigee at the times of New Moons and Full Moons are never very different from these extremes during the summer months.

When a Full Moon occurs at perigee, its size and brightness will be greater than at other times. At an extreme perigee, the Moon is about 14% closer to Earth, and so the Moon appears to be about 14% bigger. It also appears to be about 30% brighter (as brightness is related to the square of the distance). This variation in size and brightness of successive Full Moons is a celestial phenomenon that is 'seen' by everyone multiple times during their

lifetime, but is only noticed by a few people. Figure 1 illustrates this.

Variation in the Moon's face from Earth

You may have noticed while examining the two Moon images that the two images of the Moon differ not only in size, but in the position of features on the disc of the Moon. This might seem puzzling in light of the frequently-stated assertion 'the Moon always keeps the same face toward the Earth'. But this generalisation is not strictly true – in fact, the combination of the eccentricity and inclination of the Moon's orbit causes the Moon, as seen from the Earth, to nod up and down and left and right. These apparent motions, the lunar *librations*, allow us to observe, over a period of time, just over 59% of the Moon's surface from the Earth.

Effect of the Moon on Earth's tides

The gravitational pull of the Moon attracts the Earth. The solid Earth has limited flexibility and so only moves up and down by about 30 cm, whereas the oceans (being fluid) can bulge up in the direction of the Moon.

On the far side of the Earth away from the Moon, the force of the Moon's gravity is much less and so another bulge forms, because the solid Earth is also being pulled towards the Moon. As the Earth spins these tidal bulges move around the globe. The different heights of a tide from place to place depend on the way land masses block the ocean's tidal currents.

The extremes of high and low tides depend on how close the Earth is to the Sun in its orbit and how close the Moon is to the Earth in its orbit. High tides, especially Spring tides, which are extremely high 'high tides' (and have nothing to do with the Spring season), are the result of the Sun's gravity pulling in the same direction as the Moon's gravity. They



Figure 1 Image of two different Full Moons

These images were taken with the same camera and same settings, but at different Full Moons. The Moon is strikingly different at a Full Moon perigee (left) and a Full Moon apogee (right).

Most people don't notice the difference because they see the Moon in a sky that offers no reference by which angular extent may be judged. To observe the difference, you have to either make a scale to measure the Moon, or else photograph the Moon at perigee and apogee as shown here and compare the pictures.

[By John Walker, Fourmilab Switzerland]

occur at Full Moon and New Moon, as this is when the Sun, Moon and Earth form a straight line. You will observe higher 'high tides' in the Summer months at Full Moon and New Moon as the Earth is closer to the Sun.

Neap tides (when there is little difference between high/low tide) occur at First Quarter and Third Quarter Moons when the Sun's gravity is pulling at right angles to the Moon's gravity. Other bodies in the Solar System also have some influence on tides on Earth.

When there is a Full Moon and the Moon is also at perigee (the Moon's closest position in its orbit to Earth), as occurs on 26 October 2007, the Moon's gravitational effect on the tides around this time is about 30% greater than would be the case if the Moon were at apogee (the Moon's furthest position in its orbit to Earth) around this time. □

BOX 1: Sky Charts & Planispheres

- You can download free sky charts each month to explore the night sky from: <http://skymaps.com/downloads.html> OR www.sydneystar.com.au
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Photo Spot ‘Hooks’ on a Sabellid worm (a marine fan tube worm)

Sabellid worms (common name ‘fan worm’ or ‘featherduster worm’) are a family of marine worms that belong to the class Polychaeta in the phylum Annelida (segmented worms) – see Box 1. Thus polychaete worms are related to earthworms. There are more than 10 000 species in the Polychaeta class, which is the largest class in the Phylum Annelida (see Figure 1).

Sabellid worms are found in most areas around the world, from shallow to deep depths. They live on coral reefs, rocks, sand and muddy bottoms, and small species can also live on boats, wharves, pontoons, water pipes, algae and seagrasses. Some species prefer dark spots on the underside of boulders, but many are found in brightly lit areas.

Adult Sabellid worms live in long soft leathery tubes constructed of mud or sand cemented by mucus. They are sedentary but can move within the tube. The worm can rapidly contract into the tube to avoid predation, or in reaction to changes in light intensity. However, they cannot seal the tube with an operculum as do some of the other polychaete worms (the Serpulidae family). Interestingly, Sabellid worms can extend their tube as fast as coral grows, so when living in a coral habitat, they cannot be overgrown.

Sabellid worms have separate sexes and release their sex cells into the water where fertilisation can take place. The larvae that form, as with most polychaete worms, are free swimming and planktonic.

These worms range from 1 cm up to about 50 cm long. The body may be long,

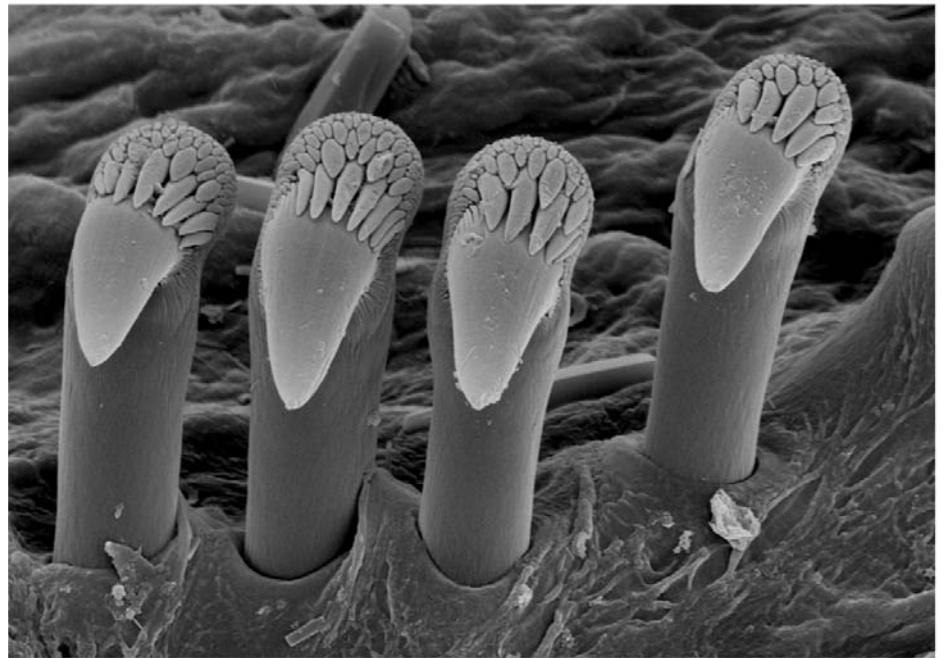


FIGURE 2: Hooks from a Sabellid Worm. Magnification is approx 12 000 x.

This photomicrograph was taken by Sue Lindsay, Australian Museum, with a scanning electron microscope.

cylindrical, and multi-segmented, or short and compact, with a limited number of segments. It consists of a head, a body and a tail region.

Each body segment has a pair of fleshy protrusions called parapodia. Although reduced in size, these parapodia function in locomotion within the tube and gas exchange. They have many hair-like bristles (or hooks), called chaetae (or setae), made of chitin.

These hooks are shown in Figure 2. They help anchor the worm in place in the tube.

Sabellid worms filter feed by extending a mass of featherlike tentacles, called a tentacular crown, out from around the mouth (see Figure 3). These tentacles function for food gathering as well as for sorting sediments to use in their tubes (see Box 2). The worms use these tentacles, as well as their body surface and gills for gaseous exchange with the environment. They can regenerate lost body parts, such as the crown.

Polychaetes such as Sabellids play essential ecological roles, serving on one hand as predators on small invertebrates, and on the other as food for fish and large invertebrates. □



FIGURE 1 ‘A variety of marine worms (in the class Polychaeta)’; plate from *Das Meer* by M J Schleiden (1804–1881).

Box 1 Scientific classification of Sabellid worms

Kingdom: Animalia
 Phylum: Annelida
 Class: Polychaeta
 Order: Sabellida
 Family: Sabellidae

Box 2 Filter feeding in Sabellid worms

The tentacles are lined with hairs (cilia) which move and create a current that draws water and organic particles to the worm. Mucus on the tentacles traps small particles from the water which are passed along a series of tracts and grooves to the mouth (in the middle of the tentacles).

Small particles are swallowed while large ones are pushed away back into the water or stored to construct the tube. Larger worms trap and eat larger particles than smaller species. The very smallest worms can filter out and eat particles the size of bacteria.

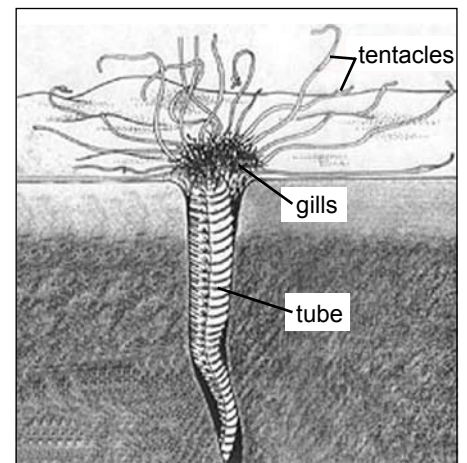


FIGURE 3 Sabellid worm tentacles extend beyond the tube which may be embedded in sediments or attached to marine surfaces.

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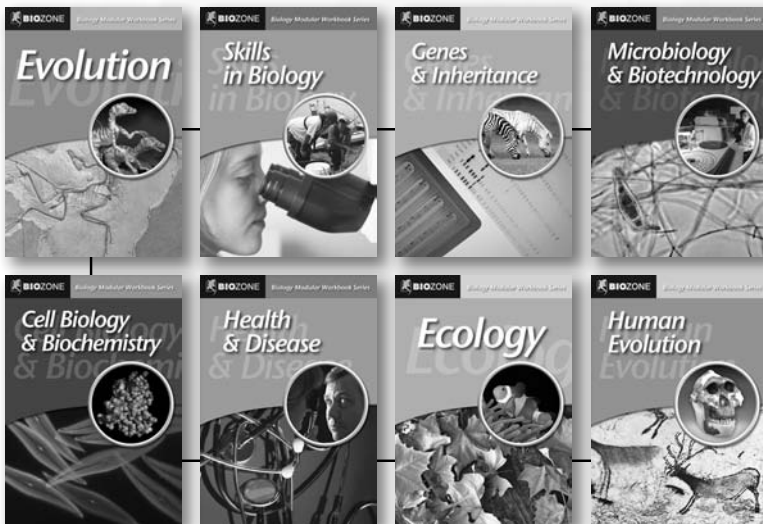
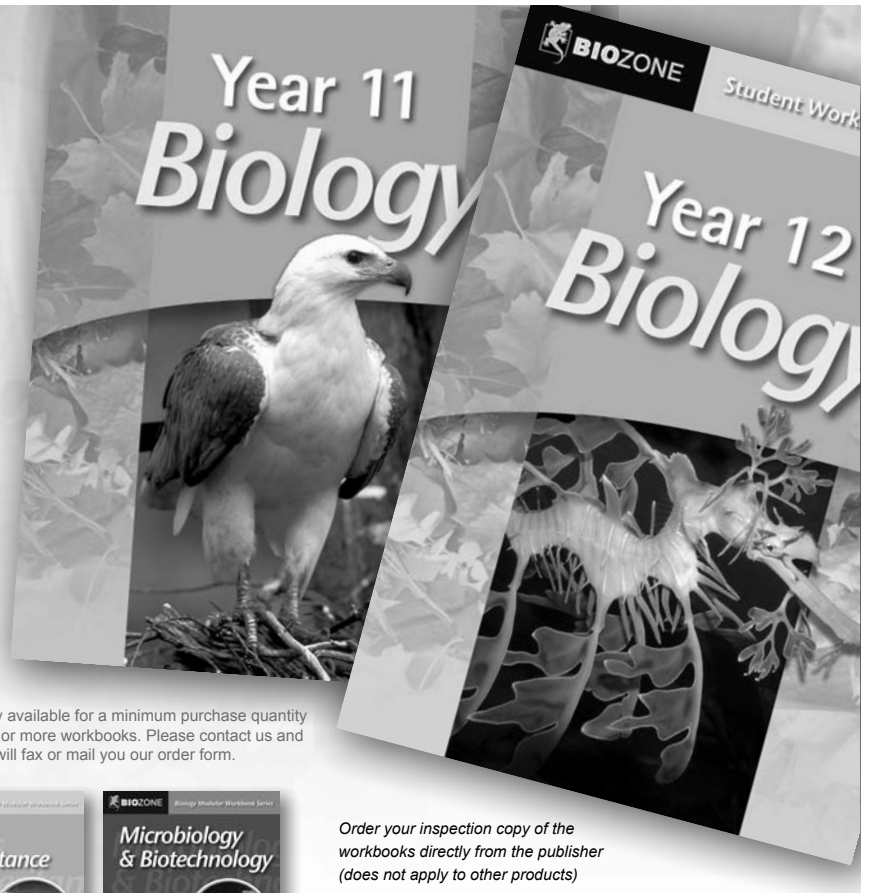
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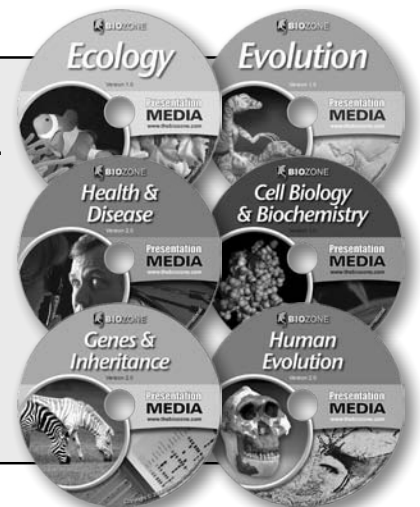
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