The Royal Society of New South Wales

Bulletin and Proceedings 329

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Future Events 2009

Lectures in Sydney are held in Lecture Room 1, Darlington Centre, University of Sydney at 7 pm on the first Wednesday of the month with drinks available from 6 pm.

Wednesday 7 October 2009 7pm

The SKAMP Project - a telescope reborn to look back in time

Prof Anne Green
Head of School of Physics
University of Sydney

Friday 30 October 2009 5.30pm

Clarke Memorial Lecture

Climate Change through the lens of the geological record: the example of sea level

Professor Kurt Lambeck, President,
Australian Academy of Science

Venue: Eastern Avenue Lecture Theatre University of Sydney

Wednesday 4 November 2009 7pm

Hominid Biogeography in South East Asia; the real significance of Hobbits

Mike Morwood, Professor of Archaeology, University of Wollongong

Southern Highlands Branch

Meetings are held on the third Thursday of each month in the Drama Theatre at Frensham School, Mittagong (enter off Waverley Parade), at 6.30pm.

next talk

Thursday 15 October, at 6.30pm

The Sun Goes on Strike!

Dr Ken McCracken

Bulletin Editor, Bruce Welch

Lecture 7 October 2009, Darlington Centre at 7pm

The SKAMP Project - a telescope reborn to look back in time

Prof Anne Green, Head of School of Physics, University of Sydney

For more than 40 years the University of Sydney has operated the Molonglo Observatory. Recently, the Molonglo Observatory Synthesis Telescope completed a detailed imaging survey of the southern sky at a frequency of 843 MHz. What next? We are undertaking a complete renewal of the signal pathway as part of Australia's contribution to the Square Kilometre Array (SKA) project, a powerful new radio telescope. Our project is the SKA Molonglo Prototype (SKAMP), which will be a new low frequency spectrometer with wide-field imaging and polarisation capability. This talk will describe the project and how it builds on the previous telescope and its scientific achievements. Two of the key science goals to be undertaken initially will be a survey of red-shifted neutral hydrogen gas and a study of the transient radio sky. With the subsequent polarisation capability, we will map the magnetic field structure of our Galaxy and explore cosmic magnetism.

Professor Anne Green is a radio astronomer whose main research focus is the study of the structure and ecology of our Milky Way Galaxy with particular interest in supernova remnants, the relics of exploded stars. She was Director of the Molonglo Observatory for ten years and is now Head of the School of Physics and Director of the Science Foundation for Physics within the University of Sydney, the first woman to hold these posiitons. Professor Green is a graduate of both Melbourne and Sydney Universities and was the first female PhD graduate in the School of Physics at the University of Sydney. She held an Alexander von Humboldt Postdoctoral Research Fellowship at the Max-Planck-Institut für Radioastronomie in Bonn, Germany, before

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CLARKE MEMORIAL LECTURE

Climate Change through the lens of the geological record: the example of sea level

Professor Kurt Lambeck, President, Australian Academy of Science

Venue: Eastern Avenue Lecture Theatre University of Sydney

Patrons of The Royal Society of NSW

Her Excellency Ms Quentin Bryce AC
Governor-General of the Commonwealth of Australia

Her Excellency Professor Marie Bashir AC CVO Governor of NSW

Weird Animal Genomes and Sex

Professor Jenny Graves, Head, Comparative Genomics Research Group, Australian National University
Director, ARC Centre of Excellence for Kangaroo Genomics,
Professorial Fellow, Department of Zoology, University of Melbourne

Lecture delivered for the Society's 1174th Ordinary General Meeting held on 2 September 2009

Professor Jenny Graves explained to a large and very interested audience at the September OGM that the sex chromosome systems of vertebrates range from the weird, to the almost unbelievable. And their evolutionary history is even stranger. Who would have guessed that the platypus has TEN sex chromosomes? Or that in some rodents the Y chromosome has vanished completely, and it may be only a matter of time before this happens in humans?

RSNSW President, John Hardie, presents the speaker medal to Professor Jenny Graves

Humans, like most placental mammals, have a simple XY sex chromosome system: XX is female and XY is male. The default status of the foetus is female which can be changed to male by hormones controlled by Y chromosome. The key sex-determination gene is SRY, co-discovered by one of Jenny's students.

Over evolutionary time there has been considerable rearrangement of the genes between chromosomes. The human X chromosome now has 1340 genes with a considerable excess of genes for brains and reproduction over what would be expected by chance. The Y chromosome, which started out as a copy of the X chromosome, has shrunk to the point where it now only has 45 functioning genes, mostly testes specific. The rest of this diminutive chromosome is junk. The Y chromosome shrinks and accumulates junk over time because there is frequent mutation, deletion and insertion, but inefficient selection and lots of drift because of the absence of recombination.

Females have two X chromosomes. So if one is defective, the other can usually serve as a back up. However, males have only one copy of this chromosome which is so important for brain function and reproduction. This absence of a back up copy explains why men have a much higher rate of mental retardation and reproduction problems compared to women.

Professor Graves and others have spent a great deal of effort in trying to unravel the evolutionary history of sex chromosomes. For many reptiles sex is determined solely by temperature. The key gene is DRT1 on their chromosome 5. Birds have a ZW sex chromosome system with ZZ male and ZW female. Bird's key sex-determining gene is also DRT1 on their Z chromosome, which is very closely related to reptile's chromosome 5. Birds and reptiles are separated by 310 million years from humans. How did their sex systems evolve into our XY system?

The key turns out to be the genome of the platypus, which was recently decoded by Jenny and her co-workers. The platypus (separated by only 166 million years from humans) has 10 sex chromosomes, 5 X and 5 Y. These are largely made up from bits and pieces of the ZW chromosome. (Note that platypi have only two sexes, not 10: all the X chromosomes group together during reproduction, so that there is effectively one multipart X chromosome, and similarly there is effectively one multipart Y chromosome.)

Some years ago Jenny and her co-workers mapped the kangaroo's genome (last common ancestor to humans 144 million years ago). They have now shown that the marsupial XY is made up from bits and pieces from five of the monotreme's 10 sex chromosomes. The kangaroo Y chromosome also has a SRY gene, new in the evolutionary record. And as for the bird's DRT1 gene? That is relocated to chromosome 1 where it now has nothing to do with sex-determination (it is also on the homologous human chromosome 9). The human X chromosome is basically the kangaroo's X-chromosome plus a large chunk of the bird's chromosome 1 (plus various brain genes from all over the place). And our Y chromosome is a shrivelled up degenerate remnant of the X chromosome. Which, if present trends hold good, may disappear in a few million years.

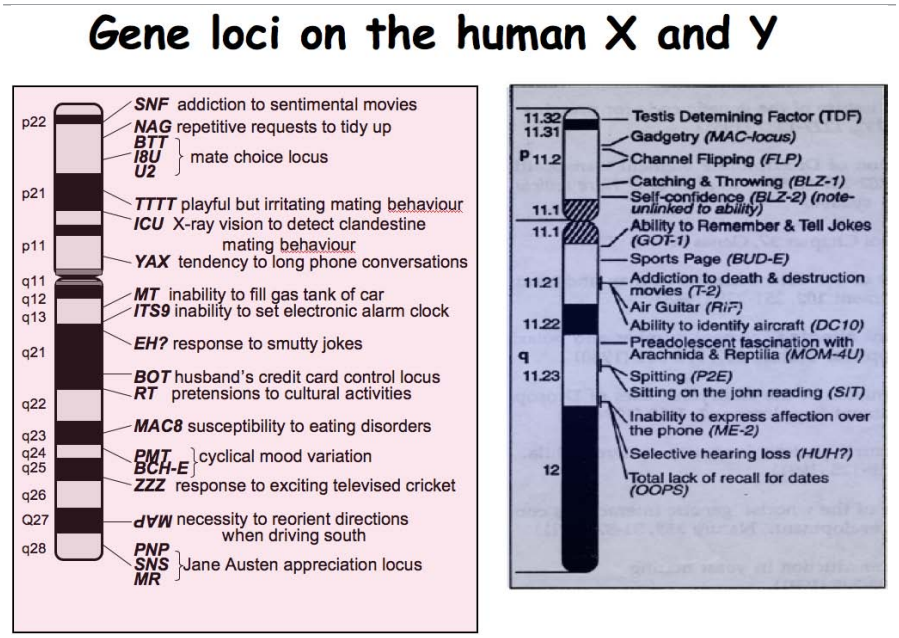
Ain't sex chromosomes weird?

Jim Franklin,

Councillor, Activities Coordinator

Prof Graves' slides (25 MB PDF) can be found at http://nsw.royalsoc.org.au/talks_2009/2009.09_Graves_Talk.pdf

More images - page 5



Latest draft of the human X and Y chromosomes – viva la difference!

From the President

Since meeting with the Sydney Harbour Foreshore Authority about Science House in July, I have met with the Director of the Sydney Region of the NSW Schools portfolio, Dr Phil Lambert, to pursue a stronger educational agenda for the building. Dr Lambert sees a great deal of merit in the project and has offered to help us with the venture.

It was a pleasure to travel to Mittagong on 5 September to be part of the wonderful 'Harmonious Revolutions' presentation given by Andrew Byrne and his consort of musicians to accompany the wonderful astronomical photographs by David Malin. The Southern Highlands Branch was fortunate in being able to attract Professor Brian Schmidt from Mt Stromlo Observatory, this year's Pollock Memorial Lecturer, to introduce proceedings by giving a broad astronomical overview in this the International Year of Astronomy.

Over the past few weeks I have been negotiating with Sydney University about a change in venue for our accommodation at the university. They have informed us that the terrace house we currently occupy will be better used as student accommodation, and I couldn't agree more. This potential crisis has turned into an opportunity in that it might enable us to occupy more appropriate and modern space within the university. It has also provided us with the possibility of providing a suitable home for our collection housed at Prestons at the moment. We are in the process of finalising negotiations so I should be able to provide more information for our next Bulletin. We will provide you with details of any relocation of the Society's office as far in advance of the event as possible.

I was delighted to be able to represent the Society at a reception at Admiralty House on 26 August for NSW organisations of which the Governor-General is patron. I was able to speak briefly to Her Excellency and wish her well for the future. It provided an opportunity for the Society to become more widely known among the other not-for-profit and non-government organisations represented at the function.

I will be representing the Society at a State Dinner being held in Adelaide in early October to mark the opening of the new Science Exchange in Adelaide. This will be a vital cog in the science communication community. It will also house the Royal Institution of Australia, which, as you know, has already involved the Society in several of its activities. We hope to build up an ongoing relationship with the Adelaide Science Exchange in all its aspects.

John Hardie

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Prof Anne Green

retiring from academia to travel Europe, live in Belgium and Switzerland and have two children. After a return to Sydney and fifteen years away from astronomy, she resumed her research career. She is now leader of the SKA Molonglo Prototype (SKAMP) project, which is prototyping technology and undertaking science projects as a forerunner to an amazing new telescope for the future called the Square Kilometre Array. Professor Green is also the Chair of the International Astronomical Union Working Group whose goal is to improve the status of women in astronomy.

New Members

Two new members were announced at the August meeting of the Society:

Michael Archer - Full Member
Peter Ralph - Full Member

We welcome them into the Society.

The Society's website now has pdf copies of some speakers' slides. See the links at the end of the speakers' abstracts or on the website at http://nsw.royalsoc.org.au/talks_2009/index_2009.html

Society's office hours extended

The Society's office in Darlington Rd, Darlington is now open on Mondays from 3.00 – 6.00 pm, Tuesdays from 11.00 am – 6.00 pm, Wednesdays from 10.00 am – 6.00 pm, Thursdays from 9.00 am – 6.00 pm, and Fridays from 10.00 am – 6.00 pm. We welcome members to visit the office during these hours. However, it is advisable to telephone in advance to make a time just to be certain. Telephone and email messages are attended to regularly.

Southern Highlands Branch

Report of August Meeting

Re-Trying Galileo: Philosophy, Science & Religion by Dr Peter Slezak, School of History and Philosophy of Science, University of New South Wales

On 25 August 1609, Galileo demonstrated his first telescope to Venetian lawmakers. Almost 400 years later to the day, Galileo was again the centre of attention when Dr Peter Slezak addressed an audience of 64 at the August meeting of the Southern Highlands Branch in his lecture entitled *Re-Trying Galileo*.

Galileo was an Italian physicist, mathematician, astronomer and philosopher, whose achievements were legendary. He has been called the "father of modern physics", the "father of modern observational astronomy" and the "father of science". Stephen Hawking says of him, "Galileo, perhaps more than any other single person, was responsible for the birth of modern science."

Controversy dogged Galileo when he championed Copernicanism at a time when numerous philosophers and astronomers held firmly to the geocentric view. When Galileo began supporting heliocentrism openly, the opposition to his views became extremely bitter. Eventually in 1633, he was tried by the Inquisition, found "vehemently suspect of heresy", forced to recant, and then spent the rest of his life under house arrest.

Peter Slezak discussed at length the nature of heresy as defined in Galileo's time, and then placed the Inquisition's finding of "vehemently suspect of heresy" in context. Heresy was seen at that time as the worst crime conceivable, a crime against God which signified the death of the soul. The heretic was viewed as having committed spiritual suicide. It followed that should such a heretic induce others to embrace his opinions, then he would also become guilty of spiritual homicide.

Being found guilty of "vehemently suspect of heresy" was not the worst finding the Inquisition could have made. More serious still would have been the finding of "formal heresy". Galileo was charged with "suspected heresy" of which there were three categories: Strong, Vehement and Slight. Lesser charges would have included, among others, erroneous beliefs, scandalous beliefs, temerarious beliefs, dangerous beliefs, necromancy, evil spells, witchcraft and black magic.

Peter Slezak quoted the views of Stillman Drake, "…I think that if Galileo's case symbolizes anything, it symbolizes the inherent conflict between authority and freedom rather than any ineradicable hostility of religion towards science. It was an accident of Galileo's time that authority happened to be vested in a particular religious institution and that his field of independent thought happened to be the creation of modern science."

At the conclusion of this well attended lecture, many philosophical questions were asked by the audience. The vote of thanks was given by Anne Wood.

Anne Wood

To continue to celebrate the International Year of Astronomy, and following Dr Peter Slezaks lecture on Galileo, the Southern Highlands Branch offered just two weeks later the musical multi-media event ***Harmonious Revolutions: Galileo & The Music of the Spheres*** at Clubbe Hall, Frensham on 5 September 2009.

The performance was introduced by Professor Brian Schmidt, astronomer at the Research School of Astronomy and Astrophysics at A.N.U. What followed was an extraordinary blending of astro-photography by Professor David Marlin, live Italian baroque music, and narrated Socratic dialogues. Soprano Anna Fraser was captivating. So too was Consort Astraea with its beautiful and haunting music played on baroque violins and violas. Andrew Byrne's performance on the lute was unforgettable.

As the audience chatted over a glass of wine at interval, it was clear that they were delighted with this multi-media production, which so skillfully integrated science and the arts.

Anne Wood

NOTICES

Australian Institute of Physics NSW Branch

8th General Meeting 2009

Tuesday 27 October 2009 at 6:30pm
Space Science in Australia: The next 10 years
Professor Iver Cairns University of Sydney
Location of talks: Slade Lecture Theatre, School of Physics, University of Sydney.
Refreshments are available from 6:00pm. Entrance to all events is free.

Dinner to follow at Buon Gusto Restaurant, Abercrombie St.
Please contact Dr Fred Osman on 0418 444 477 to book.

Australian Nuclear Association

ANA 2009 Conference

Theme: Nuclear Science and Technology for Australia and the World

08.30-18.00 Friday 2 October 2009 at Sydney Mechanics School of Arts, 280 Pitt Street Sydney, NSW

The keynote speaker will be Dr Ziggy Switkowski.

For information on the program and a registration form go to www.nuclearaustralia.org.au/

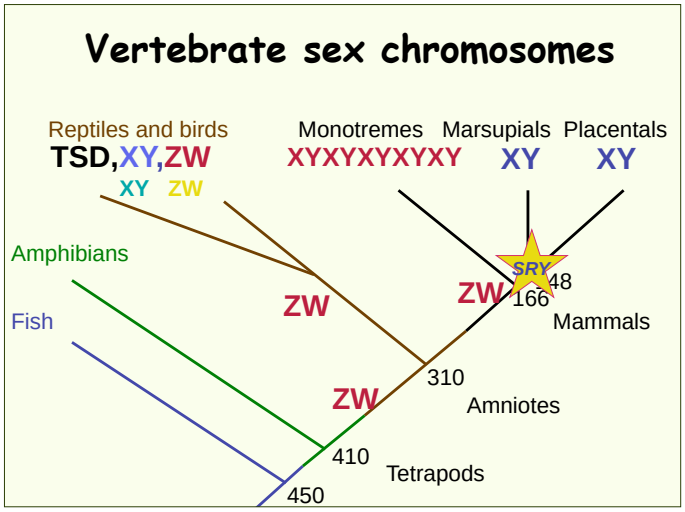
Registered delegates are invited to tour the OPAL reactor, the Neutron Guide Hall and the ANTARES accelerator at ANSTO from 2:00 to 4:30pm on Thursday, 1 October, before the conference. Please contact Dr Peter Airey at pairey@optusnet.com.au or tel:0404 257 515 for further details..

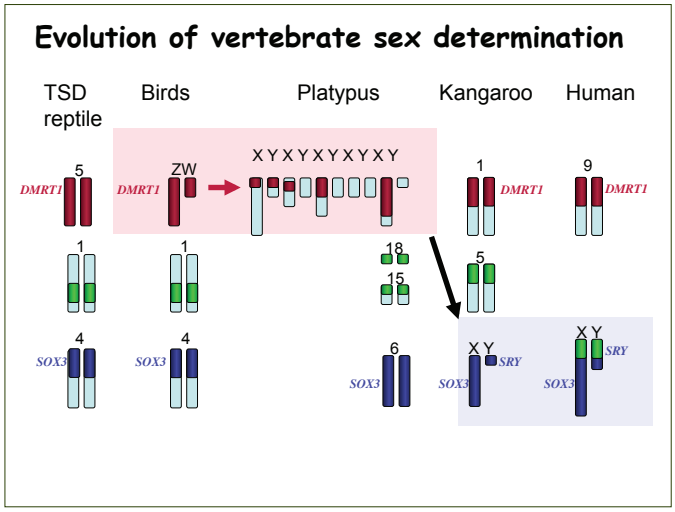
RACI News

Weekly E-News (including forthcoming events) of The Royal Australian Chemical Institute Inc. NSW Branch are obtainable on their web site at http://www.chem.unsw.edu.au/raci/News.html

Weird Animal Genomes and Sex

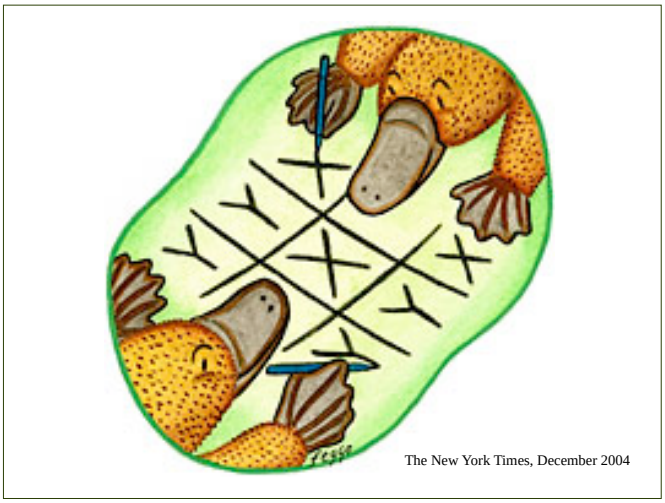
Selected slides from Professor Graves' lecture (see page 2)





Warren et al et al 2008

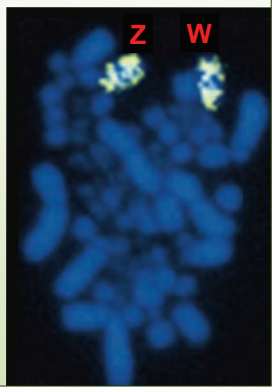
- smallish (2.6 Gb)
- 52 (weird) chromosomes
- milk genes
- egg yolk genes



Other birds?

Emu

ratite bird, ~80MY



Sex chromosomes ZZ / ZW

Paint emu chromosomes with chicken Z

- chicken Z= emu Z
- emu Z= emu W

Visit the web site www. science.org.au/unintelligentdesign especially http://www.science.org.au/unintelligentdesign/designs/cells/platypus-graves.htm

One Hundred Years Ago . . .

Dear Members,
Given the recent problems that General Motors is facing in the United States I thought I would provide you with something to do with motor cars.

The One-Wheeled Car
By Lawrence Hargrave

Read before the Royal Society of N. S. Wales, September 4, 1907

It is the special privilege of members of this Society to have a journal as a sort of bank in which they can safely deposit ideas of a more or less bizarre nature, which when first presented appear ridiculous, but when printed and circulated have a way of being first looked into and examined critically by the most remote people, and their merits recognised and acted on. Then, it may be after many years, the invention, or an application of well known laws, is brought to its place of origin as a valuable foreign production. This being the unalterable way in which humanity is built, must be accepted without demur. The particular idea that is here described is a method of simplifying land locomotion by making one wheel suffice where two or more have previously been used.

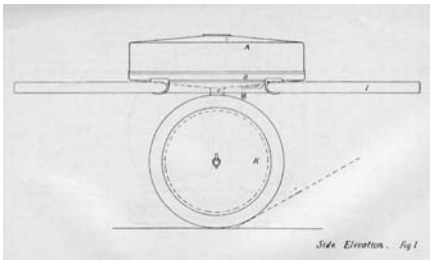
After many millions of boys had spun and whipped tops, it was discovered that when the top is spun in fixed bearings in a surrounding cage, the top and cage will remain in any position, apparently defying gravity. This is the gyroscope, and after thousands of men had spun gyroscopes, one man substituted a torpedo for the cage and span [sic] the top with its axis coinciding with that of the torpedo; thus, as in the Howell torpedo, combining motor and rudder. ... Then Brennan span [sic] his tops on horizontal axes on a mono-rail car, and found that it would not capsize: and now I want you to see that there is a great advantage in spinning the top on a car with one wheel only; and that by so doing, any country [that is] not precipitous can be negotiated by a motor car so fitted, the car being always on an even keel.

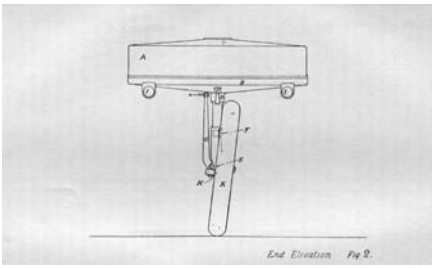
On the English principal that if it is possible to make one part have two or more functions, it is good mechanics to *combine the top and motor*. You are therefore, referred to Plate V., Vol. XXIII., 1889, Plate III., Vol XXIV., 1890, and figures 3, 4 pages 62, 63 Vol. XXXII., 1898 of our Society's Journal for samples of motors in which the cylinders revolve on fixed crank shafts instead of using the ordinary method of fixing the cylinders and rotating the crank shaft. There are many ways of arranging radial cylinders and vertical shafts, but in all of them the cylinders act as a powerful gyroscope at right angles to the shafts, and the pistons and rods gyro on the crank pins. The two-stroke oil motor is particularly suitable for a gyro-engine, the speed of rotation removing several air cooling and lubricating difficulties.

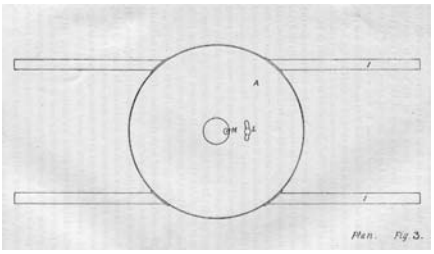
The power may be taken from the gyro-engine to the tired wheel either by the friction pulley and disc, or by the worm gear as in the models. ...

[Hargrave then proceeds, over the next two pages, to describe in great detail the mechanical construction of this contraption. He concludes with the following paragraph.]

The division of the power is a matter of interest. If the car is on a perfect track,







little push is required, leaving a large balance to speed up the gyro and carry a large weight. If the car is on a steep and stony hillside, plenty of push is wanted, and some of the live load must walk to leave enough gyro to sleep the remainder.

From: *Journal and Proceedings of the Royal Society of N. S. Wales.* Vol. XLI 1907. pp. 88-94

PS. This particular volume in my personal collection has the following text written on the front inside page:

Professor T.W.E. David
Received June 23rd 08

Dr Michael Lake
September 2009

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