The newspaper of the physics community

interactions

April 2006

Institute *of* Physics

Women advance but not enough

Heather Pinnell reports on recent efforts to improve the position of women in science.

The progress of women in physics was the focus of several events to mark International Women's Day on 8 March. The UK Resource Centre for Women in SET (UKRC) held its second annual conference, where it launched a photographic exhibition celebrating six inspiring women scientists (right).

The Institute's own Women in Physics Group held a welcome event for women physics students, which was addressed by speakers representing careers in industry, academia, journalism and government. The group recently extended free membership to all 2200 female undergraduate members.

Since March 2002, when the first International Union of Pure and Applied Physics conference on women in physics was held in Paris, there have been many positive developments – both at the Institute and nationally.

In 2003, Council set up the Women in Physics Policy Committee and appointed a full-time staff member for women's issues. The government also commissioned Sir Gareth Roberts to write a report, *SET for success*, which identified a future shortage of science, engineering and technology (SET) graduates and noted that this could be addressed if more women were recruited. In response, the government set up the UKRC in 2004.

Work has continued apace at the Institute. Between 2003 and 2005, 40% of UK university physics departments were visited by a panel that assessed how welcoming they are to women. The panel noted a lack of transparency in promotions and appointments and said that the long-hours culture is often a problem for women with children. A similar scheme of industry site visits is planned.

The Institute will shortly publish a review of research into girls and physics as well as a guide for teachers on how to keep girls interested in the subject.

The Royal Society is also making efforts to improve the situation for women in science. Last June it launched the Athena SWAN Charter – an award scheme to encourage universities to demonstrate their commitment to advancing the careers of female scientists. In the first round of awards, announced in March, silver medals went to Imperial College, London and the chemistry department at Edinburgh University.

There are many reasons for the persisting shortage of women in physics.

Robert Taylor/UKRC

Clockwise: Wendy Hall, Jocelyn Bell Burnell, Maggie Aderin, Julia Goodfellow, Kathy Sykes, Rebecca George.

The long-hours culture in physics departments is often a problem for women with children.

These include the difficulties of returning to science after a career break; combining childcare with the demands of a career in science; women following their partners when they relocate; lack of networking opportunities; lack of transparency in hiring, promotion and pay; few visible role models for women and the continuing problem of gender stereotyping.

Many of these factors were identified in the Institute's report *The 3Rs: Recruitment, Retention and Returning*, published in March 2004. Following on from this, the Institute conducted a survey of women taking career breaks and published a guide to planning a successful career break.

The gender balance has certainly improved in the last 50 years, says Gillian Gehring, who started as an undergraduate in 1959 and was only the second female professor of physics when appointed in 1989. By March 2005, the number of women professors had risen to 26, but many believe this upward trend has now reached a plateau.

The proportion of female physics professors has increased only slightly in recent years, to around 4%. Female A-level entries and undergraduate numbers seem to have stuck at around 21–22% for the last 10–15 years and, while women make up 24% of those employed in SET, they hold only 12% of managerial positions.

Gillian Butcher is an active member of the Women in Physics Group and a research associate in space instrumentation at Leicester University. She says that, while there are more female physics undergraduates than when she was at university 20 years ago, there are very few women working at her level in her field. "When I was an undergraduate there were six women out of 40, which was quite good at that time. You thought, it's all going to happen and it's all going to change. But I now wonder where they all are."

Katharine Hollinshead, the Institute's diversity programme leader, says there is a strong business case for making women more welcome. Technology-based industry faces similar imbalances to those in academia, with women making up just 4% of directors in the top 100 technology companies.

"There are huge numbers of women who have SET qualifications who are not actually working in the sector, and it's a waste of resources. Companies need to move beyond seeing it as a legislative requirement to see the positive aspects. You can see it as a ticking-the-box exercise or as a real opportunity for your company or university."

CONTENTS

"Am I a traitor to my physics roots?"
Kate Bellingham on teaching maths, p4

"Skydiving is a lot closer to flying than to falling."
Jules Hoult, p5

"One of the joys of podcasting is listening to programmes from the other side of the world."
Samuel Rae, p8

BRANCH NEWS

Edinburgh to celebrate Maxwell Year

The Institute of Physics in Scotland is joining in celebrations of the 175th anniversary of the birth of James Clerk Maxwell in 2006, which has been designated Maxwell Year. The James Clerk Maxwell Foundation, with the Royal Society of Edinburgh, Edinburgh University, Heriot Watt University, the national museums of Scotland and the City of Edinburgh, have set up a series of events between April and October to mark the anniversary.

These will include lectures by Malcolm Longair and Basil Mahon, author of an acclaimed book about Maxwell, a poster competition for primary schools and an exhibition at Maxwell's family home in Parton in Dumfries and Galloway. Maxwell's school, the Edinburgh Academy, will also open a new science facility in the autumn to be named the James Clerk Maxwell Centre.

A diamond of a science facility

On 1 March Simon Alcock of the Diamond Light Source told the Institute's Midlands Branch members about this new science facility, the largest in the UK for over 30 years. The giant machine, which is housed in a doughnut-shaped building with a circumference of half a mile, is a particle accelerator designed to produce synchrotron light in the form of x-ray, infra-red and ultra-violet beams of exceptional brightness. The Diamond Light Source will open in 2007 and should enable scientists to probe deep inside matter and answer fundamental questions about everything from the building blocks of life to the geological origin of our planet. Synchroton light also has important practical uses — it has been used to study the molecular structure of chocolate to help food manufacturers create the best tasting bars.

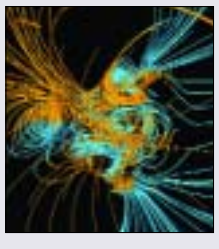
The physics of juggling – harder than you'd think

On 28 February members of the Institute's South Central Branch were treated to a display of amazing feats of both juggling and physics. Colin Wright, a physicist who has set up the juggling company Solypsis, explained that juggling tricks can be represented by diagrams that look a bit like Feynman diagrams. These allow him to model new tricks to see if they'll work out the way he hopes.

The length of time a ball spends in the air is represented by a discrete variable that can take negative values – in other words it can travel backwards in time. Wright pointed out that a particle travelling backwards in time is considered to be the same as an anti-particle travelling forwards in time – so why not an anti-ball? You don't actually see the anti-ball, of course, or indeed its partner; what you see is the juggler's empty hand. Wright wowed the audience with some amazing juggling before going on to explain how Heisenberg's Uncertainty Principle also applies to the ball–anti-ball pair.

Flipping from pole to pole

It has been known for 100 years that the north and south magnetic poles have swapped positions many times in the geological past, but the idea still has the power to fascinate. A talk on geomagnetic reversals for the Institute's Merseyside Branch on 2 March drew a lively audience. John Shaw, a professor of geophysics at Liverpool University, described the two approaches to studying reversals and determining when the next is due. The first involves sampling rocks that record the intermediate geomagnetic field – which is neither normal nor reversed – and then trying to determine how the field changes as the reversal progresses. This can be quite challenging as the reversal process can be as short as 5000 years, but results indicate that the intermediate field is very weak — just 10% of normal — and probably doesn't have a simple dipole shape. The second, using a supercomputer to model the Earth's geodynamo, appears to show the same basic pattern. The last reversal was 780 000 years ago and, given the past rate of four every million years, the next is already overdue.



New strategy for UK technology

By Ayala Ochert

"Research is about turning money into knowledge and innovation about turning knowledge into money," said former Institute president Sir Gareth Roberts as he welcomed the Institute's business affiliates to the year's first Key Insight Business Briefing on 13 March.

The meeting drew together technology experts and business leaders to discuss the UK's new national technology strategy, which was announced in 2004. The strategy is being formulated by a business-led Technology Strategy Board and its chairman, Graham Spittle, director of IBM's Hursley Laboratory, was the first keynote speaker of the evening.

"Science and technology are the fundamental bedrock of wealth creation but UK companies have not embraced them at the pace needed. That's where the technology strategy comes in," said Spittle.

His board is trying to drive up investment by businesses in R&D, from just 1.2% of GDP to the government's target of 1.7% by 2014. Spittle said that a "step change" in UK innovation was vital, given developments in countries like India and China. "The pace of change in those countries is more fierce than you can imagine, and the challenge for us is immense."

The Technology Strategy Board has a budget of £360 m to spend on supporting the development of promising technologies; £260 m of that has already been distributed, with 40% going to small and medium-sized businesses. Spittle said the board was looking for risky investments that might pay off in the next five to 10 years.

The board is also creating "innovation platforms", which will bring together stakeholders from government and the business and research communities. These platforms aim to link businesses with procurement opportunities. A company developing a new medical technology, for example, could get access to buyers in the National Health Service.

The UK lags behind on business spending on R&D, but the situation in Germany would appear to be much better, with investment at 2.6% of GDP – two-thirds of the country's total spending on R&D.

Reinhard Grunwald, secretary-general of the German Research Foundation, told the audience about the German situation. Investment comes mainly from the automotive industry, while other R&D-intensive industries – such as those involved in the manufacture of machinery and pharmaceuticals – are starting to decline.

"The writing is on the wall in Germany," said Grunwald, stressing that all countries in Western Europe face the same challenges in transitioning to a knowledge-based economy that can compete with lower-wage countries like India, China and the nations of Eastern Europe.

JOINT MEMBERSHIP AGREEMENT

Institute president Sir John Enderby (right) signed a joint membership agreement with Peter Jackson, the president of the Institute of Physics and Engineering in Medicine (IPEM). The agreement will make it easier and cheaper to be a member of both organisations, with a 25% reduction on each subscription. It also creates a fast track for corporate members of IPEM to register as chartered physicists. "The agreement will benefit people working in all areas of medical physics and encourages closer collaboration between our two institutes," said Enderby.

Long-term study of graduates begins

In February the Institute began a study that will track the paths taken by physics students after they graduate. The longitudinal study will follow physics graduates for the next 10 years to see how many stay in physics, where the rest end up and how much they earn. The study will also provide detailed information about gender, ethnicity and disability to see if and how these affect their future opportunities.

While there is government data on where students end up immediately after they graduate, no-one has followed students beyond this. Peter Main, the Institute's director of education and science, has been encouraging physics departments across the country to promote the survey to their final-year students.

"With the closure of several physics departments, the results of this survey will help departments to formulate better strategies for recruiting new students," he says.

The study will recruit final-year undergraduate physics students into the study for several years to see how demographic and employment patterns change over time. The Institute hopes to get as many students to participate as possible. "We all want to promote physics to more people. And what better way than to show potential physics students the varied career paths physicists take and the wide opportunities available to them?" says Main.

Final-year students who have not already done so can fill out the questionnaire online at www.sunion.warwick.ac.uk/onlinesurvey/iop.

An astronomical tour begins

Joanne Page reports on the new Schools Lecture, which this year has a cosmic theme.

The Institute's annual Schools and Colleges Lecture tour began in the North East on 10 March. The lecture, Gravity, Gas and Stardust, was given by Pete Edwards to 120 students at the Science Learning Centre in Durham and included a 3D space fly-through and stunning astronomical images.

Edwards is coordinator of public outreach at the Ogden Centre for Fundamental Physics at Durham University, and he beat stiff competition to become this year's lecturer. "It can be hard to find practical demonstrations for a cosmology lecture, but Pete had some good ideas and his 3D videos are great," says Nicola Hannam of the Institute's education department.

The lecture is aimed at 14-16-year-olds and will tour the country until the end of the year, visiting more than 40 venues. "The aim is to take the audience on a journey through the cosmos, exploring some of the latest results from the world of astronomy and what they may reveal about the birth, life and death of our universe," says Edwards.

Paul Sidney

Pete Edwards displays some stunning images of the galaxies, and shows he isn't afraid to look silly.

Using images from the Hubble Ultra Deep Field published in 2004, Edwards begins by showing the students that there are over 10 000 galaxies in a patch of sky that would be obscured by a single grain of sand. "All we get at school are simulations, so seeing real images was fantastic," said teacher Steve Hetherington, who brought his class from Framwellgate School, Durham.

To understand how astronomers and cosmologists study the universe the students view spectra through diffraction gratings; a Doppler ball and a giant balloon help to demonstrate redshift. In a memorable demonstration of the Doppler effect, Edwards does an impression of an ambulance as he runs around the room. "You have to be prepared to look a bit stupid," he admits, but the audience seem to enjoy that.

From this basic physics, Edwards then moves into the latest research in cosmology. The audience don 3D glasses for a fly-through of the local universe using the results from the Two Degree Field Galaxy Redshift Survey, completed in 2002. This simulation shows real images of the galaxies in their positions relative to each other, and the fly-through reveals the large-scale structure – the "cosmic web". Edwards then shows how cosmic microwave background data from the WMAP satellite, published in 2003, was used to create the largest simulation of the evolution of the universe to date. The Millennium Simulation of 2005 follows 13 billion years of cosmic history and again shows the beautiful filament-like structure of galaxies in 3D. The physics department at Durham University was involved in the production of both simulations.

During question time at the end of the lecture, Edwards was able to show once again the impact of recent research on our understanding of the universe. In response to the question, "When was the Big Bang?", he explained that just three years ago the answer would have been 12–15 billion years ago, but since the WMAP cosmic microwave background data became available the answer has been narrowed down to 13.6–13.8 billion years ago.

When asked: "What caused the Big Bang?" Edwards took the opportunity to invite the students to study physics and help to answer this and other as-yet-unanswered questions about the universe, such as: what happened in the first second after the Big Bang, why is the expansion of the universe speeding up and where is the missing matter in the universe?

http://teachingphysics.iop.org

International body meets at Institute

The newly elected executive council of the International Union of Pure and Applied Physics (IUPAP) met at the Institute of Physics headquarters in London on 24–25 February.

It was a fitting venue as the organisation is considering moving its secretariat to the Institute in 2008 from its current location at the American Physical Society in College Park, Maryland, where it has been for the last six years.

At the meeting the council discussed how it plans to carry out the resolutions made by the General Assembly in Cape Town in October 2005. Two major priorities identified in Cape Town were physics education and physics for development.

In order to increase the number of developing countries in IUPAP, the council agreed that membership should initially be free for certain countries and later be subsidised.

Nuclear 'will not halt CO_2 crisis'

Many scientists – including the government's chief scientific adviser, Sir David King – have been arguing that the UK needs new nuclear power stations in order to stave off global warming. But, on 9 March, the Institute's Energy Management Group heard from one scientist – Storm van Leeuwen – who says that nuclear power will not help reduce greenhouse gas emissions.

He also told the meeting that there is only enough uranium in the world to sustain the current generation of nuclear reactors – and no more.

Van Leeuwen, an expert reviewer for the UN's Intergovernmental Panel on Climate Change, presented his complete life-cycle analysis of a nuclear reactor.

"A reactor is part of a complex system, and all those processes emit carbon dioxide from the burning of fossil fuels or through chemical reactions. It always costs energy to release freely usable energy," he said.

His study calculated how much energy is needed to convert uranium ore into nuclear fuel, to construct the power plant and keep it going, to dispose of the waste and, ultimately, to decommission the reactor. The energy involved at each stage can be significant, explained Van Leeuwen. For example, after a nuclear reactor is shut down, it has to be cooled for decades before it can be dismantled.

One of the main limitations of nuclear power, he went on, is the availability of high-grade uranium ore. As the ore grade approaches 0.01% uranium, the carbon dioxide emitted by the nuclear reactor – taken over its whole lifetime – becomes comparable with that emitted by a conventional gas-fired power plant. The energy produced by the reactor also falls off rapidly as the ore grade decreases.

There only remains enough high-quality uranium ore to maintain and then run down the world's existing nuclear reactors, but not to replace them with new reactors or to expand nuclear power, said Van Leeuwen. Yet 164 new reactors are currently on order worldwide.

"This is an argument between economists and physicists," said Van Leuween. Economists believe that higher uranium prices will drive the discovery of new sources. "But physical facts suggest otherwise. There are no indications that new rich deposits are to be found. Physical laws cannot be circumvented by economics."

Van Leeuwen did not look at breeder reactors because these are unlikely to come online in the next two decades. He also did not include the use of weapons-grade plutonium as a nuclear fuel because of the attendant risk of nuclear arms proliferation.

ANNUAL GENERAL MEETING 2006

The announcement of Council's nominations in the March issue of *Interactions* contained the wrong dates for nominations and for the AGM. The correct date for the AGM is 20 July 2006 at 2.00 p.m. at 76 Portland Place, London W1.

Since the last issue of *Interactions*, the Bylaws agreed by members at the AGM in 2005 have been approved by Privy Council and take effect from 16 March 2006. The new Bylaws change the process for nominations by members for elections to Council.

Under the new Bylaw 70, Council has nominated the following candidates for election to serve on Council.

David Smith is a physics teacher at Dr Challoner's Grammar School in Buckinghamshire, where he has worked since 1998. In his time there he has helped make physics the second most popular A-level. Before becoming a teacher he worked for 22 years in semiconductor physics research at the GEC-Marconi Hirst Research Centre, where he rose to a senior management position. In addition to being an excellent teacher, he has made valuable contributions to the Institute's own Physics Update courses.

Harjinder Obhi is senior legal counsel for Network General, an international IT business. Upon completion of a PhD in high-temperature superconductivity at Cambridge University in 1994, he obtained sponsorship to attend law school. Until last year he specialised in intellectual property and law relating to technology at Bristows, a London law firm. He has also written extensively on intellectual property law (including in *Physics World*) and was founding chair of the Institute's Physics and Law Group. He is also a member of the Institute's Ethics Committee.

The new Bylaw 71 states:

"Any twenty Corporate Members may nominate any other duly qualified person as a candidate for election to any one or more of the said offices by depositing at least five weeks before the Annual General Meeting such nomination in writing at the office together with the written consent of the nominee to accept office if elected. No Corporate Member may nominate more than one candidate in any year for any one vacancy."

Nominations under Bylaw 71 must be received by Christine Cornwell, clerk to the Council no later than **12 June 2006**.

The new Bylaws also make provision for members to submit resolutions to the AGM. Each resolution must be submitted by no fewer than 20 members and be received no later than **12 June 2006**. The full details of the new Bylaws are available at http://about.iop.org/IOP/objectives.html.

Physics and maths should go together

Kate Bellingham

"If the training was more flexible, they might attract more physicists into teaching."

"Physics 'could die out in state schools' due to lack of teachers." When I read this headline and others like it last November, I had already spent several weeks observing lessons in a local school to help me decide whether to make a career change into teaching. The headlines were based on research from the University of Buckingham that showed, among other things, that 24% of 11–16 schools don't have a single physics specialist and 30% of physics teachers are due to retire in the next decade.

My own experience may give some insight into why physics teachers are fast becoming a dying breed. I have a physics degree from Oxford, an MSc in electronics and experience working as a computer programmer, an engineer and a presenter on television and radio. But, despite all this, the lessons I've been observing are maths lessons.

When I first investigated the opportunities in teaching, I phoned the Teaching Information Line and explained that I had experience in physics, maths and electronics. I was told that these were three different subject areas, and that I would have to choose just one to train in.

Electronics is part of design and technology, and I felt that I had nothing to offer in the rest of that subject. Physics? That comes under "science", and you need to train across the whole subject. I'd dropped biology and chemistry when I was 16 and had no intention of reviving them. So that left maths.

For four months I have spent every Monday morning at my local secondary school, sitting in on lessons and helping out where I can. I have had some real moments of satisfaction, helping children work through a mathematical concept and seeing the look of pleasure on their faces as the penny drops. A simple "thanks, Miss" can be immensely rewarding.

But am I a traitor to my physics roots? When there is such a dire shortage of physicists to teach physics, shouldn't I be out there supporting my subject? What I'd really like to do is train in physics and maths – two subjects that surely have at least as much in common as physics and biology. Last November, fired up after reading those headlines, I decided to contact the Training and Development Agency for Schools (TDA) with a suggestion – if the training was more flexible, they might attract more physicists.

The good news is that, in doing so, I discovered that my brief encounter with the Teaching Information Line didn't give the full picture. I already knew that, as a former engineer, I could take part in the Graduate Teacher Programme (GTP), which means that I could learn to teach on the job at my chosen school and be mentored in my chosen subject (with an afternoon a week at the local university to cover more general aspects of teaching).

What I hadn't realised was that I could do a PGCE specialising in physics, doing just enough biology and chemistry to fulfil the requirements. I also discovered that, once qualified, it would then be up to me and the school that employs me to decide what subjects and ages I would teach. That could include maths, physics and electronics. The bad news is that it's still not possible to do a PGCE in maths and physics together. Apparently, teachers need to be qualified in one complete subject, and it is impractical to cover the whole of maths plus physics on top.

Un-balanced science

Given the current, desperate lack of confident and capable physics teachers, I would like to see the TDA show leadership and initiative by supporting a new qualification in maths and physics. I'm sure I'm not the only physicist put off "balanced science" because of a reluctance to teach biology.

It's true that I could do the bare minimum of biology and chemistry in order to fulfil the requirements of a science teaching qualification – even if I never taught those subject areas. But to those who say "you wouldn't have to do much of it" and "I'm sure you'd be perfectly adequate", my answer is: "I'm not prepared to compromise".

In the meantime, my advice to other physicists considering a move into teaching is this – get all the information you can and find the training route that suits you. Make sure you are treated as an individual case and don't be put off by demarcations in the education system. It is frustrating that the school departments don't seem to align with science in the "outside world". But as a physicist you are a rare commodity, and schools are sure to welcome you with open arms.

Kate Bellingham is a former presenter of the BBC's *Tomorrow's World* and is president of Young Engineers, a national network of engineering clubs in schools and colleges.

focal point: physics in society

Help us help you communicate your passion for physics

Einstein Year was a great excuse to celebrate physics and all it has to offer society. It was also a great opportunity to get physicists around the country involved in workshops, talks, demonstrations and debates aimed at taking physics to public audiences. Here at the Institute, we hoped that Einstein Year would help to increase the quantity, and the quality, of outreach done by real physicists.

To a large extent, this part of Einstein Year seems to have been a success – more than 500 locally organised events took place last year. Of course, many physicists have been involved in outreach for years, so the real challenge during 2005 was to encourage new communicators through a combination of financial and practical support.

The Einstein Year and branch grant schemes provided access to funding, while resources such as the Physics to Go and Einstein's Birthday Party packs provided tried and tested ideas for activities. In addition, 20 university-based physicists attended a day of practical workshops that allowed the participants to experiment and build their confidence in front of a friendly audience before trying out their new skills in public.

To ensure that the enthusiasm generated in 2005 continues now that Einstein Year is over, the Institute has created the **Physics in Society programme**. One of the programme's main objectives is to continue to increase and improve outreach activities across the country.

Einstein Year is currently undergoing an independent evaluation, which is looking at what motivated people to do physics outreach. The final report is due at the end of April and will be made public so that the whole community can learn from it.

In the meantime the Institute is conducting an online survey of outreach activity **(http://surveys.iop.org/outreachsurvey)** to find out what members are already doing and how best to support them. Is there a need for training workshops to build confidence and share best practice? Do you want better tools to help you evaluate your current activities and plan future ones? Can the Physics in Society team advise you on generating publicity and attracting a wider audience? Or would you get involved if only we produced more resources?

Of course, we're not starting from scratch. We already offer support in the form of the Public Engagement Grant Scheme. There is an electronic discussion list for physics communicators at **http://networks.iop.org/archives/physics_comms.html**. The resources developed during Einstein Year are now available at **www.physics.org**, and Lab in a Lorry provides rewarding volunteering opportunities **(www.labinalorry.org.uk)**.

In fact, a recent independent evaluation of Lab in a Lorry showed that what makes it such a great experience is the enthusiasm and spirit of the volunteers. This interaction with real scientists is invaluable for inspiring the next generation of physicists, and the Physics in Society programme aims to support as many of you as possible in doing just that. So please fill in the survey and let us know how we can help you.

Caitlin Watson was programme manager for Einstein Year and now manages the Physics in Society programme.

profile: Jules Hoult

Teaching in freefall

Ayala Ochert meets a physics teacher with a passion for skydiving.

David Haygarth

Jules Hoult puts his faith in the laws of physics as he steps out of a plane with his skydiving companions.

Most people remember the dreams of flying they had as children, but in Jules Hoult's case he was determined that this dream would someday become a reality. He was captivated by planes and flew in the cadet force at school and later in the University Air Squadron at Durham, where he was trained by real RAF pilots. Then, in 1997, he took the leap into skydiving. "Skydiving is a lot closer to flying than to falling, especially if you wear a wing suit. There's no sense of acceleration – you just step off into the airflow," says Hoult. "I've flown all the way round clouds and down the sides. Chasing clouds is beautiful."

Since then, he has done more than 1200 jumps, and he's still just as passionate about the sport. A few years ago, he also started using skydiving as a way to get children interested in his other passion – physics. Hoult has been teaching physics for 14 years and is currently head of physics at Uppingham School in Rutland.

He originally developed his talk on the physics of skydiving, which includes video footage of himself in freefall, for his own class. But he has since taken the talk round the country and given it more than 30 times. In it he explains how skydivers can change their fall rate by changing their cross-sectional area, how they manoeuvre, and why they jump from 13 000 feet, as well as talking about the physics involved in modern parachutes.

Hoult has always taught at independent boarding schools, an environment that is familiar and which he enjoys. He grew up in Hull in a musical family and, when he was just seven years old, auditioned for a place as a chorister at King's College School in Cambridge – which he won. With the help of music scholarships, he spent the next 10 years in boarding school.

He recalls the physics and maths teaching he received as "solid, if not inspirational". But his imagination was captured by books on nuclear physics and quantum mechanics that he found in the school library, including *The Strange Story of the Quantum* by Banesh Hoffman. Full of enthusiasm for the subject, he studied physics at Durham University but found the degree disappointingly dull. Nevertheless, he remained interested in the subject and decided to become a physics teacher.

Hoult tries to inspire his pupils with lively lessons and by showing how physics is relevant to their lives. Not afraid to try out new ideas and techniques, he's piloted the Institute's own Advancing Physics A-level and the 21st Century Science GCSE. "21st Century Science is a really good course that teaches some valuable skills and addresses the concept of scientific literacy – what you need to know to be a competent member of society," he says.

Yet, like many in the independent sector, from September he plans to teach the International GCSE (IGCSE). He admits that the syllabus looks very traditional, but the attraction is that it has no practical coursework assessment. "These assessments are just a series of hoops to jump through, and the pupils hate them. It takes all the fun out of practical work, which is something that should make science special." Hoult says the IGCSE will allow him the flexibility to teach physics the way he sees fit.

"Assessments take all the fun out of practical work, but that's what makes science special."

Schools in the state sector will not have this choice. From September they will have to teach one of the new science GCSEs, one of which will be 21st Century Science, to be certain that they have met the government's requirements. As chairman of the Institute's Education Group, this is something that worries Hoult. The group has analysed the new courses and has expressed its concerns about them. "21st Century Science is the only one that has been piloted and, if I had to make a choice, it's the only one I would consider," he says.

The group fears that the current review of science A-levels will also result in an overemphasis on practical assessments. "There are two fantastic physics A-level courses out there – Advancing Physics and Salters-Horners. They are imaginative and well thought through, but they're going to have to be changed simply to fit this new assessment model."

For his next challenge, Hoult is again looking skyward. His school has just installed a dome on the roof of its science building and has bought a 12 inch reflecting telescope. "There's no astronomy in the IGCSE, but we'll be teaching it anyway," he says, adding that astronomy is a great way to get even the least science-oriented children interested in physics.

"I've been teaching astronomy to my bottom set for the last two weeks, and they've been avid. I think there's a deep fascination with astronomy, based on a fundamental desire to know what's out there and how we all fit in."

OBSERVATIONS

Marieke Navin describes the four weeks she spent underground in Japan, helping with the reconstruction of the Super Kamiokande neutrino detector.

Set deep in a mine in the Hida mountains in Japan, Super Kamiokande is the world's largest neutrino detector at 40 m tall and 40 m in diameter. It's filled with 50 kilotonnes of ultra-pure water surrounded by 13 031 photomultiplier tubes (PMTs). In 2001, a single PMT near the bottom of the tank collapsed, causing shockwaves that destroyed 60% of the tubes. The Japanese temporarily restored it but with a drastically reduced sensitivity. A six-month project is now underway to restore "Super K" to optimum sensitivity, and the international collaborators have each agreed to volunteer some of their time to the refurbishment effort. As a PhD student at Sheffield University, it's now my turn to spend a month in Japan helping to replace the damaged tubes.

16 January

I wake to an early, freezing start and for the first time see Mozumi's snow-covered hills surrounding us. I arrived in the dark last night feeling a little apprehensive about spending four weeks working down a mine in the middle of nowhere but excited about being in Japan. The 20 minute, 3 km mine train ride is loud and dark and not for the faint-hearted. We don clean suits, hairnets, shoes, helmets, toolkits, radios and buoyancy aids and enter the detector area. My first glimpse of the Super K tank is breathtaking. It's half full with water, giving a sense of its massive scale.

I'm part of the outer detector team, which will connect the cables from the PMTs being installed by the inner detector team. In training, to my huge relief, I succeed in making my first of many connectors. Later we're lowered by gondola onto the floating platform of the outer detector and learn about recabling. It will take four days to complete a circle of the tank; then the water level will be lowered to reveal more PMTs. The process will be repeated until all 18 rows are refurbished.

17 January

I'm less nervous now and start to enjoy the work. At lunch some of the Korean scientists share *kimch'i* with us, the spicy Korean side dish of salted and pickled vegetables. There are also colleagues here from China, Poland and the US – a truly international effort.

20 January

My job today is to follow the radio-worker after the connections have been tested and melt the heat shrink over them with a hot-air gun to waterproof the cables. It's incredibly tedious and makes my arm ache as I have to bend to reach the heavy cables of the bottom two PMTs. I'm thoroughly exhausted but this evening I've been invited to a Japanese house for a birthday celebration. We try grilled fish from the local river and home-made wine from mountain grapes and four different kinds of sake.

25 January

Wake up to a blizzard. We grab shovels and dig out the cars. At lunchtime we take a trip into the inner detector. I get to sail in the orange dinghy I've seen in all the photos. It's amazing to be inside the detector. Today I've been given a radio and I am to perform the connection tests. I even learn how to communicate with the electronics hut worker in Japanese! "*Signal o tsunagatteimasu*" means "signal connected".

7 February

I'm now considered an expert and train the people who will replace me. I can't believe it's coming to an end and wonder if I'll ever get the opportunity to be inside the Super K tank again. I've been involved in the cabling and signal checking of 2736 PMTs. It's been a fabulous experience and I hope I'll be back in 2009 to do data collection and calibration, which should be much less physically demanding.

Photographs of Marieke Navin's visit are at www.shef.ac.uk/physics/people/mnavin. To contribute to **OBSERVATIONS** send an e-mail with your idea to interactions@iop.org.

interactions

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AWE has got morals

Jim Grozier's letter is too simplistic ("Take a moral stance", March). Far from "eschew[ing] any moral stance", I made a positive moral decision to work at the Atomic Weapons Establishment (AWE).

Outside work I am a Labour Party activist and a member of Amnesty International. My work also has relevance to nuclear fusion power, which may help to avert global warming.

My reading of 20th century history is that there is real evil in the world and that dictators will take what they want by force and threats and, if unopposed, will interpret this as weakness and try to take more and more. We need to be prepared to fight both to deter and to resist aggression; pacifism and appeasement don't work.

I assume Jim Grozier and I want the same thing: a peaceful and just world. He shouldn't be so quick to dismiss those with different views about how to achieve this.

Steve Rothman
Tadley, Hampshire

Jim Grozier attempts to link the decline in science teaching to the existence of the AWE.

Far from diminishing opportunities in physics, AWE provides them. It also actively supports local schools in the teaching of science, and a significant number of its scientists voluntarily give up their time to help in schools.

It's not out to "recruit" school leavers but aims to foster an interest in science in pupils that will encourage them to extend their science education into college and possibly university.

Lee Upcraft
Reading

Plug the hole

Your recent articles on physics teaching leave me with a feeling of déjà vu. I was a physics teacher from 1993 to 1999, and I wrote to *Physics World* back then about why I left teaching. What continues to amaze me is that no-one talks about retaining physicists in teaching, nor is there any sign of any effort to do so, let alone to encourage good ex-teachers back into the profession (as has happened in the nursing profession).

It is worrying enough to consider the bald statistic that 30% of physics teachers will reach retirement age over the next 10 years, yet few of my friends who are still teachers anticipate getting anywhere near retirement before they leave the profession. The physicists among them have an almost limitless choice of alternative careers, few of which have as high a stress level as teaching.

Am I alone in thinking that if the taps are failing to fill the bath, some consideration might be given to ways of putting the plug in?

Tim Peters
Sidcup, Kent

Comic-book units

Prof. Kakalios is to be commended for his method of attracting and retaining students' attention in physics classes ("Heroic physics from the parallel world of comic books", March). But when he shows students the physics exhibited by superheroes in comic books and action movies, I hope he pays more attention to the units he uses.

He writes: "After falling 100 m Gwen would have been moving at nearly 95 mph." What does the symbol "m" in "mph" refer to in that statement? Presumably miles but, in that case, the "m" on the previous line should refer to miles too, meaning that Gwen had fallen 100 miles, not 100 metres. Perhaps he could express speed in furlongs per fortnight or, better still, teach his students about SI units and stick to that well-established international system in his calculations.

John Scott
Glen Ridge, New Jersey, USA

Looking-glass world

In the Marvin and Milo cartoon (March), the lens effect of the glass of water is incorrectly drawn, with left and right not consistently reversed, and there should be nothing behind the glass when viewed through the water's upper surface.

Tom Syson
Cardiff

Write to interactions@iop.org or the address above. Letters may be edited for length.

notices

NEW MEMBERS

Peter Ainscough, Richard Blackwell-Whitehead, Ian Buckley, Raymond Butler, David Carter, Tim Cartwright, Kan Choo, Marcus Gibbs, Anthony Hodge, Theodoros Horikis, Mark Ibison, Stephen Jolly, Robert Klie, Wing Lee, Neil Lee, Nicholas Pope, David Ryan, Peter Schober, Andy Sibley, Konstantin Stefanov, George Stewart, Michael Swanwick, Matthieu Verstraete, Irena Vorgul, Robert Walls, David Hill, Colin Welsh.

NEW FELLOWS

Geoffrey Anderson, R Barnett, David Bradley, Paul Brown, Robert Cywinski, David Lewis, Stephen McQuillan, Atanas Popov, Simon Richards, Timothy Sumner, Keith Worden, Andrew Worrall.

IN MEMORIAM

B C Abbott, Robert Bain, John Bunton, Fenwick Charlesworth, Douglas Ernest Clark, R Coelho, Peter Kirby (Newcastle-upon-Tyne), Vadim Kuznetsov, Stanley Martin, C W McCombie, Evan Rosser, Peter R Smith (Loughborough), Charles Tottle, E J Williams, William F Williams.

WANTED

● **Two project managers for a major Institute initiative – Stimulating Demand for Physics**. Following a successful application for funding to the Higher Education Funding Council for England, the Institute of Physics is launching a major project to increase participation in physics-based courses in higher education, to broaden the pool of entrants to such courses and to build on the current Institute initiatives in this area. The Institute is looking to recruit two people: one to manage university-based projects and the other to manage school-based projects. If you are interested in applying for either of these roles, contact the Institute's human resources department for further details (e-mail recruitment-london@iop.org or telephone 020 7470 4800). The deadline for completed applications will be the end of April.

● **Scientists to take part in an MP–Scientist Pairing Scheme** to help build bridges between parliamentarians and scientists in the UK. More than 100 scientists and MPs have taken part since the scheme was set up by the Royal Society in 2001 as part of its Science in Society programme. The scientists are briefed by the Royal Society and experience a week in Westminster attending seminars and spending time with their MP, and there are reciprocal visits to the MP's constituency office and the scientist's laboratory. Please contact Chloe Sheppard for further information about the scheme (chloe.sheppard@royalsoc.ac.uk) or see www.royalsoc.ac.uk/mp.

MEMBER NEWS

● **Prof. Marcus Wigan** of the Transport Research Institute and School of Computing at Napier University, Edinburgh, has been appointed as a visiting professor at Imperial College London for 2006 and 2007, following his involvement in the OPUS project for EUROSTAT.

MEMBER OFFER

● **Online subscription prize draw**
Alex Byrne from Caversham, Surrey, is February's prize-draw winner. He receives a 512 MB data stick. For your chance to win a data stick, pay your subscription online at http://members.iop.org when you receive your subscription notice.

Visit whatson.iop.org for full details of all Institute of Physics events.

APRIL 2006

Magnetic Nanomaterials
Half-day workshop to showcase UK R&D in magnetic clusters, particles and grains.
Magnetism Group
76 Portland Place, London W1
3 April
http://conferences.iop.org/MAGNAN

The Design of Morphing Aircraft
Talk by Prof. Mike Friswell of the University of Bristol.
South-West Branch
Dirac House, Temple Back, Bristol
4 April
http://sw.iop.org/Events.htm

From the Solar System to the Edge of the Observable Universe
Talk by Dr Robin Catchpole of the University of Cambridge.
London & South-East Branch
76 Portland Place, London W1
5 April
http://london.iop.org

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Royal Station Hotel, Neville Street, Newcastle
5 April
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Swallow Three Tuns, New Elvet, Durham
6 April
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

The Quest for Extrasolar Planets
Talk by Prof. Keith Horne of the University of St Andrews.
Merseyside Branch
Surface Science Research Centre, University of Liverpool
6 April
http://merseyside.iop.org

Artificial Pitches and the Games They Play on Them
Talk by Dr Colin Walker of the University of Strathclyde.
IOP in Scotland
James Weir Building, Montrose Street, University of Strathclyde
6 April
http://scotland.iop.org

Bio-Dielectrics: Theories, Mechanisms and Applications
Conference on dielectric studies in biology, with particular focus on the interaction of non-ionising electro-magnetic fields with biological tissues.
Dielectrics Group
University of Leicester
10–12 April
http://conferences.iop.org/BID

SCHOOLS LECTURE 2006

Gravity, Gas and Stardust
Various venues throughout England, Scotland and Wales.
April – December 2006
An interactive presentation by Dr Peter Edwards of Durham University. Aimed at 14–16-year-old students, it covers such questions as: how and when did our universe begin, how did it evolve and how will it end?
Education Department
http://teachingphysics.iop.org/events/student_events/schools_lecture

Particle Physics 2006
Annual conference of the High Energy Particle Physics Group of the Institute.
High Energy Particle Physics Group
University of Warwick
10–12 April
http://groups.iop.org/HE

33rd IOP Annual Conference on Plasma Physics
Conference spanning all branches of plasma physics.
Plasma Physics Group
Crieff Hydro Hotel, Crieff, Scotland
10–13 April
http://reld.phys.strath.ac.uk/IoP2006.htm

Commercialising Research for Biophotonics
Emerging Technology Programme event.
Business & Innovation Department
76 Portland Place, London W1
12 April
dipali.chauhan@iop.org

Condensed Matter and Materials Physics (CMMP 06)
Themes to include nanoscience and correlated quantum systems.
Condensed Matter and Materials Physics Division
University of Exeter
19–21 April
http://conferences.iop.org/CMMP06

ONE-DAY MEETING

Electrostatic Charge in Combustion Physics
Topics include combustion ignition, flame measurement and conditioning fuel electrostatic atomisation, plasma catalysts and particulate filtering.
Electrostatics Group
76 Portland Place, London W1
18 May
http://conferences.iop.org/ECC

Preservation and Conservation Issues Related to Digital Printing and Digital Photography
A two-day conference for conservators of prints, photographs and textiles.
Printing, Papermaking and Packaging Group
76 Portland Place, London W1
24–25 April
http://conferences.iop.org/PPP

The Use of Biophotonics to Revolutionise the Diagnosis and Therapy of Cancer
Talk by Dr Nick Stone of Cranfield Postgraduate Medical School.
South-West Branch
Elwes Building, University of Gloucestershire, Cheltenham
25 April
http://sw.iop.org/Events.htm

The Man Who Changed Everything: the Life of James Clerk Maxwell
Lecture by Dr Basil Mahon, author of an acclaimed book about Maxwell.
IOP in Scotland
Fraser Noble Building, Old Aberdeen Campus, University of Aberdeen
25 April
www.maxwellyear2006.org/html/events.html

The Man Who Changed Everything: the Life of James Clerk Maxwell
Lecture by Dr Basil Mahon, author of an acclaimed book about Maxwell.
IOP in Scotland
Tower Extension Lecture Theatre, City Campus, University of Dundee
26 April
www.maxwellyear2006.org/html/events.html

Characterisation of Photovoltaic Materials and Devices
One-day meeting covering all photovoltaic technologies.
Materials and Characterisation Group
76 Portland Place, London W1
26 April
http://conferences.iop.org/CHA/index.html

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Ramada Jarvis City, Ingram Street, Glasgow
26 April
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Thistle Aberdeen Altens, Souterhead Road, Aberdeen
27 April
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

The Man Who Changed Everything: the Life of James Clerk Maxwell
Lecture by Dr Basil Mahon, author of an acclaimed book about Maxwell.
IOP in Scotland
Glasgow Science Centre, Glasgow
27 April
www.maxwellyear2006.org/html/events.html

Nanotechnology: the Next Industrial Revolution
Talk by Prof. Philip Moriarty of the University of Nottingham.
Merseyside Branch
Surface Science Research Centre, University of Liverpool
27 April
http://merseyside.iop.org

The Risky Side of Radiation
Lecture by Dr David Twiss of New Cross Hospital, Wolverhampton.
Midland Branch
Chancellors Building, University of Keele
27 April
http://midland.iop.org

The Man Who Changed Everything: the Life of James Clerk Maxwell
Lecture by Dr Basil Mahon, author of an acclaimed book about Maxwell.
IOP in Scotland
Michael Swann Building, Kings Buildings, University of Edinburgh
28 April
www.maxwellyear2006.org/html/events.html

Photonics North West
Meeting to highlight regional activities in applied photonics.
Optical Group/Materials and Characterisation Group
University of Manchester
28 April
http://groups.iop.org/OP

ONE-DAY MEETING

In Situ Electron Microscopy and Analysis
The meeting will present the state of the art, communicate new findings and discuss future directions. Oral and poster contributions are invited.
Electron Microscopy and Analysis Group
76 Portland Place, London W1
30 June
http://conferences.iop.org/ISEM

Move Over Einstein – the Next Generation is Here!
Oxford Science Trust, Oxford
1 April – 4 June
A free interactive exhibition of contemporary physics for young people – now extended until August 2006.
www.moveovereinstein.org

MAY 2006

How Materials Science is Saving the Environment
Lecture by Prof. Colin Humphreys of Cambridge University.
Midlands Branch
Oakham School, Oakham
2 May
http://midland.iop.org/calendar.htm

Where on Earth Am I?
Talk on global positioning by Dr Malcolm Cornwall of the Open University.
London & South-East Branch
76 Portland Place, London W1
3 May
http://london.iop.org/meetings.html

Big Bang: the History of the Universe in 60 minutes
Talk by well known science writer and broadcaster Dr Simon Singh.
London & South-East Branch
Weston Auditorium, de Havilland Campus, University of Hertfordshire
3 May
http://london.iop.org/meetings.html

Visit to the Lairdside Ship Simulator
Visit to the Lairdside Maritime Centre ship-handling and pilotage training facility.
Merseyside Branch
Campbell Town Road, Birkenhead, Wirral
9 May
http://merseyside.iop.org
Booking essential

The Search for Life on Other Planets
Talk by Prof. Glenn White of the Open University.
London & South-East Branch
Church Lecture Theatre, Open University, Milton Keynes
9 May
http://london.iop.org/meetings.html

The Data Deluge and the Grid
Talk by Prof. Steve Lloyd of Queen Mary, University of London.
London & South-East Branch
76 Portland Place, London W1
17 May
http://london.iop.org/meetings.html

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Best Western Queen's Hotel, Southsea
17 May
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

Fusion
Talk by Prof. Sir Christopher Llewellyn-Smith of UKAEA Culham.
Merseyside Branch
Daresbury Laboratory, Warrington, Cheshire
23 May
http://merseyside.iop.org

Suck, Squeeze, Bang, Push: the Physics of the Jet Engine
Lecture by Neil Glover of Rolls-Royce.
Midland Branch
St John Fisher High School, Newcastle-under-Lyme
25 May
http://midland.iop.org/calendar.htm

Physics of the Stradivarius
Talk by Prof. Colin Gough of Birmingham University.
Manchester Branch
Schuster Building, Manchester University
29 May
http://manchester.iop.org

Stirling Physics Meeting
Annual meeting for physics teachers from Scotland.
IOP in Scotland
University of Stirling
31 May
http://scotland.iop.org/events.html
Booking required

Pulsars
Talk by Prof. Jocelyn Bell Burnell of the University of Oxford, and branch AGM.
London & South-East Branch
76 Portland Place, London W1
31 May
http://london.iop.org
Booking essential

JUNE 2006

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Plymouth (venue to be announced)
7 June
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Bristol (venue to be announced)
8 June
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

Annual Physics Teachers Meeting
18th annual meeting for teachers of physics in schools and colleges in England and Wales.
Education Department
Rugby School, Rugby, Warwickshire
8 June
http://teachingphysics.iop.org
Booking required

Plasmas Surfaces and Thin Films
One-day meeting with invited speakers and poster presentations.
Ion and Plasma Surface Interactions Group
76 Portland Place, London W1
14 June
http://conferences.iop.org/PST

Physics Can Be Easy!
A free day conference on Key Stage 3 and 4 physics, including workshops, updates and hands-on experiments.
Merseyside Branch
Chadwick Physics Building, University of Liverpool
22 June
http://merseyside.iop.org
All teachers of physics, including non-specialists and trainees, are welcome

Summer School for Physics Teachers
Residential event providing discussion and enrichment opportunities for teachers in Scotland.
IOP in Scotland
University of Glasgow
26–30 June
http://teachingphysics.iop.org/teacher_support/inset/summerschool06.pdf
Booking required

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Yorkshire (venue to be announced)
28 June
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

Mobile Careers Surgery
One-to-one careers advice for Institute members.
Professional Standards Department
Yorkshire (venue to be announced)
29 June
http://careers.iop.org/Mobile-careers/mobile_careers_surgery.html
Booking required

lab in a lorry
get connected to science

Lab in a Lorry – the interactive mobile laboratory for 11–14-year-olds – will be touring the UK and Ireland throughout 2006. For details on how to register your interest, or to volunteer, see **www.labinalorry.org.uk.**

Naked scientists top the Internet charts

Samuel Rae discovers the brave new world of podcasting.

These days you can't board a bus or a train without seeing at least half a dozen iPods or other mp3 players, cocooning their owners in a cosy bubble of their favourite music downloads. I've always looked on smugly, assuming that these people are foolishly closing themselves off from the outside world. But it seems that, thanks to the new phenomenon of the podcast, these people are just as likely to be catching up with the latest news, brushing up on their Spanish language skills or finding out about the latest developments in astrophysics.

The word "podcast" was voted Word of 2005 by the New Oxford American Dictionary, which defines it as "a digital recording of a radio broadcast or similar program, made available on the Internet for downloading to a personal audio player" (although you don't actually need an mp3 player – you can listen to podcasts on your computer). Podcasting, I discovered, looks set to change not only the way we listen but what we listen to.

Opening up iTunes (the free mp3 software from Apple) for the first time, I was struck by the sheer number of podcasts in the science category – 470 when I looked, and all free to download. But are they any good? To find out I trawled through and listened to as many as my ears would take.

The popular science magazines all seem to have their own podcasts – *Scientific American* and *New Scientist* both making it onto Apple's top 20 most popular podcasts. They are professionally produced, with flashy music tracks and sound effects. A silver-tongued presenter introduces the week's main science stories, followed by interviews with scientists about their work. Like many of the science podcasts I listened to, they let the scientist explain their own research, which I found a refreshing change.

The *Scientific American* podcast stands out thanks to its presenter, Steve Mirsky, who asks some insightful questions. I also really enjoyed its Totally Bogus section, in which four unbelievable science-related stories are presented and listeners have to guess which one of them is a bluff.

Some podcasts are radio broadcasts that have been made available on the Internet. *The Naked Scientists* radio show is broadcast weekly on BBC Eastern Counties Radio, but it attracts a worldwide audience through podcasting. Presented by a cast of real scientists, the show is fun and informal, with a focus on science in everyday life. In one episode Peter Brennan, an expert on the science of smell, was asked why farts seem to linger longer when you're in the shower – exactly the kind of question that scientists should be asked more often, I think.

The creator of *The Naked Scientists*, Cambridge virologist Chris Smith, also presents the *Nature* podcast. This is more formal and news-oriented but good if you're looking for in-depth science coverage. Like the journal itself, it's aimed at an audience who work in or around science. For example, one of the stories I listened to had a discussion about the alternatives to the current system of ranking journals by citations alone.

One of the joys of podcasting is being able to listen to radio programmes from the other side of the world. Every week Dr Karl on Triple J (Australian Youth Radio) throws open the phone lines for people to ask their burning science questions. A great variety of people phone in – like the builder who wanted to know if sitting on concrete really causes piles. The show is completely unscripted, which makes it very funny at times, and when Dr Karl doesn't know the answer he's not afraid to admit it. A helpful listener will usually e-mail in a response.

Another entertaining podcast from overseas is *Slacker Astronomy* – a weekly round-up of astronomy news produced just for fun by three American astronomers that has built up an impressive audience of more than 14 000 regular listeners.

While most science podcasts are news based, there are some that are intended as permanent educational resources. Michelle Francl, a lecturer at Bryn Mawr College in the US, has produced 26 podcasts, each one a chapter of *An Introduction to Quantum Chemistry*. And there's also the excellent *Ask an Astronomer* series from NASA, which is accompanied by videos that you can view in iTunes (or on a video mp3 player, if you're lucky enough to own one).

Perry Hastings

"Naked Scientists" Brian Wallace (left), Chris Smith and Helen Scales at work.

Podcasting looks set to change not only the way we listen but what we listen to.

Although it's not strictly speaking in the science category, BBC Radio 4's *In Our Time* is definitely worth a mention. This history of ideas discussion programme is presented by Melvyn Bragg and seems to feature science almost every other week. Its excellent choice of topics and expert contributors makes it one of the best programmes out there.

A useful feature of iTunes is that it allows you to subscribe to your favourite podcasts, so you need never miss an episode. By the time I finished writing this article a whole new batch of podcasts had appeared on my computer. I've always been a fan of science on the radio because it allows me to expand my mind and do the washing-up at the same time. Now, thanks to the podcast, I can listen to great science programmes wherever and whenever I like.

Samuel Rae is the Institute of Physics outreach officer.

particles