Newsletter #2 Autumn 2004

SCI-FUN to collaborate with the Medical Research Council

We are delighted to announce our collaboration with the Medical Research Council's Human Reproductive Sciences Unit (MRC HRSU), for the Edinburgh International Science Festival in 2005. This event will combine our experience in bringing science to schools with the topical research interests of the scientists at the HRSU, making its work accessible to a wider audience.

The HRSU is based in Edinburgh, and is a leader in the field of reproductive science. Its research interests include reproductive cancers, infertility, novel methods of contraception, and diseases such as endometriosis. While providing SCI-FUN with an insight into the science involved, there will also be an opportunity for students and scientists at the unit to help us deliver our programme. The Director of the HRSU, Professor Robert Millar (shown opposite), is highly supportive of any endeavours that make science more accessible to the public, particularly in our schools: "I am especially keen to encourage the young scientists here at the unit to effectively communicate their science to the wider community. Our involvement with SCI-FUN will help us to contribute to the public understanding of science, whilst improving the communication skills of our scientists."

The arrangements for the science festival are in the 'neonatal' stages of development, but we are all looking forward to our joint efforts in this venture. The involvement of the MRC HRSU may lead to further developments, including the opportunity for schools to be given talks by scientists from the unit. Keep an eye on our website for updates, and if your school is interested in a visit from a scientist... let us know!

SCI-FUN Director Dorothy McMurrich and Development Assistant Donna Dalgetty, with Professor Robert Millar of the MRC HRSU

Evening Sessions – taking science to the wider community

"I was dragged along by my son tonight. Science has always scared me…but tonight was brilliant…now I'm having to be dragged home!"
– A P7 parent at a recent evening show.

Talks and hands-on sessions for the public have always been a feature of SCI-FUN, in the past mainly at science festivals such as Edinburgh, Orkney and Shetland. Recently, however, we have offered some schools an evening session, and these have proved so popular that such sessions are a regular feature this year. They are generally offered to P7 pupils with their parents and to Primary School teachers, giving the secondary school and the associated primaries an additional opportunity to work together and to ease the transition from Primary to Secondary.

A tornado in a box

Evening sessions begin with hands-on access to the roadshow exhibits, followed by a one hour show on a scientific subject, with demonstrations, multimedia displays and opportunities for volunteers to take part. The emphasis is on fun, and we try to get over to the audience our passion for science in general, and the ways in which it affects all of our lives.

Two shows are currently available: *Wild Weather* and *Powers of Ten*. *Wild Weather* is presented by SCI-FUN's Deputy Director, Brian Cameron (of whom more on the next page). During his show he describes and demonstrates the science that gives us our fantastic weather – including giant hailstones and planes being hit by lightning – and creates tornadoes and lightning bolts to order.

Our other show, *Powers of Ten,* uses numbers with a scary amount of zeroes to investigate the science of the very large (taking a tour through the solar system) and the very small (looking at cells, DNA and inside the atom). Along the way there are a few explosions, bad hairdos and a freaky hamster!

One of the *Powers of Ten* slides

Part of the grant from the Motorola Foundation has been used to fund the evening sessions this term, from August to December. The Institute of Physics has awarded a grant for a number of evening sessions in the first six months of 2005, Einstein Year. (The Institute of Physics in the UK and Ireland has named the World Year of Physics as Einstein Year in celebration of 1905, the year in which Einstein published his ground-breaking papers on Brownian motion, the Photo-electric effect and Special Relativity.)

SCI-FUN's Deputy Director: Brian Cameron

The re-structuring of SCI-FUN in 2000 marked the start of Brian's official commitment to SCI-FUN and the transition from willing volunteer to Assistant Director (as a willing volunteer!) Three years later, the re-structuring of the University resulted in Brian's "real" job as Chief Technical Officer in the Institute of Meteorology changing to Senior Technical Officer in the School of GeoSciences. At the same time he became officially recognised as the Deputy Director of SCI-FUN. Since then he has combined the roles, and taken on a new role in publicity and recruitment for GeoSciences.

For those of you who may not know what GeoSciences encompasses, the School was formed from the Departments of Geography, and Geology and Geophysics, and the Institutes of Meteorology and Ecology and Resource Management. Brian's role in both organisations benefits both: SCI-FUN develops links with staff and students in GeoSciences; and GeoSciences gains an opportunity to promote the fascination of earth and atmospheric science in schools throughout the country.

Brian's commitments to GeoSciences prevent him from taking part in many of the school visits during term-time, but evenings? Whenever possible, Brian will get behind a wheel (or on his bike) to get to an evening session and give a talk or a workshop. His talks this year are on "Clouds and Wild Weather" – for the audiences experiencing this show the sky will never appear quite the same again! He uses all the skills acquired over the years to entertain and educate an audience ranging from 7 to 70 years old. (His neighbours have probably wondered why he takes so many photos at night from his bedroom window!)

Brian Cameron, giant hailstone in hand, presenting the *Wild Weather* evening show

Edinburgh team win *Teach First* prize

"A fantastic project… ready to roll out to schools tomorrow."

This was how one educationalist described *Forensically Challenged?*, an outstanding idea devised by University of Edinburgh science and engineering students to encourage young peoples' understanding of maths and science.

The *Scientifically Challenged?* team

Michelle Gilbert, Suzanne-Marie Parker and James Pritchard (collectively called *Scientifically Challenged?*) won the runner-up prize of £3,000 at the first ever *Teach First* Challenge – an event that encourages students to devise innovative new ways to teach maths, science, IT or design.

This prize-winning team used forensic science to relate the science learned in a secondary school classroom to the real world. Pupils use science to identify a criminal before writing up a report backing up their accusations.

One of the team, Suzanne-Marie Parker, said: "We tried to remember the things we liked when we were younger: the programmes we watched and the books we read. Mystery, suspense and drama seemed to intrigue all of us. Forensic Science is often seen as gory but fascinating, making it especially interesting to young teenagers."

Forensically Challenged? is an investigative team assignment. Pupils, working in small groups, are given evidence from a crime scene and use basic scientific techniques to build evidence against suspects, ultimately identifying the criminal. The investigations develop scientific methods and thinking, reinforcing basic concepts without straying far from the syllabus.

In August, SCI-FUN offered to help the team test their still evolving prototype under the challenging conditions of a real classroom setting. Staff and S2 pupils at Gracemount High School were kind enough to act as enthusiastic guinea pigs (and by all accounts thoroughly enjoyed the day), and the experience helped the team to iron out a variety of minor issues before making their trip to London.

We will be working with the *Scientifically Challenged?* team in the near future to develop their prototype into a full-blown project kit, available for schools to hire. (Full details will be made available at a later date.)

Parker, again: "Science is often given a negative reputation, and it's difficult for children to see past this. We hope that through the *Forensically Challenged?* workshop, and other collaborations with SCI-FUN, we can help to remove this unfashionable stigma."

Read the team's full article and examine the school forensics kit in detail on our website at www.scifun.ed.ac.uk/misc/forensic.html.

If you think that your school would be interested in making use of this workshop, contact Dorothy McMurrich for further details.

The Postgraduate Science Communication Team

For the past four years, University of Edinburgh postgraduates have been taking a leading role in a diverse variety of public engagement of science activities. The Postgraduate Science Communication Team (PGSCT) was originally set up through funding by Nikon Precision Europe and is now in its fourth year.

Since its establishment, team members have been sharing their enthusiasm for science through activities such as: giving talks; running debates; facilitating after-school science clubs; visiting schools; running workshops in science centres and museums; writing articles; developing activities and hands-on science exhibits; and getting involved with events in National Science Week and the Edinburgh International Science Festival.

There are major training and development benefits for members of the postgraduate team. While some members of the team may move into careers in science communication, most will work as professional scientists in academia or industry, or will move into fields such as teaching or the financial sector. Involvement in public engagement of science activities will aid the development of high levels of transferable skills relevant to all of these careers: communication skills, teaching skills, teamwork, confidence, flexibility and planning.

The team work with a diverse range of formal and informal educationalists; in particular the team members support the work of SCI-FUN. Team members work with SCI-FUN's full time presenters to help deliver the roadshow, and to develop new ideas. Jan Barfoot, coordinator of the PGSCT said, "The partnership between the PGSCT and SCI-FUN is an excellent way of ensuring that the young research scientists of today are brought into contact with those of tomorrow. We are pleased that the PGSCT can support the work of SCI-FUN, helping to promote science in Scottish Schools."

Find out more about the Postgraduate Science Communication Team: contact Jan Barfoot on 0131 650 7042, or email j.barfoot@ed.ac.uk.

The 50th Anniversary of CERN – a SCI-FUN visit

Huge detectors, weighing thousands of tonnes, built with the precision of a watch; super-conducting electromagnets requiring the electricity supply of a small town to create titanic magnetic fields, bending near-light-speed particles into circular paths, then focusing them precisely to collide with such force that brand new particles – not seen since the Big Bang – are created from pure energy; vacuum fields as good as the vacuum of near-space; a world-wide network of computer centres to process the vast amounts of data from particle collisions; gigantic civil engineering projects: thousands of gallons of liquid nitrogen used to freeze an underground water table; 27 kilometre circular tunnels, 100 metres under the ground; the largest cranes on the planet, used to lower the detectors into their underground caverns; over 2500 vans and hundreds of bicycles, just to move staff and equipment around the complex…

…welcome to CERN, the European Organisation for Nuclear Research, and the world's largest particle physics centre, where thousands of scientists and engineers from eighty-five countries work together to study the building blocks of matter and the forces that hold them together.

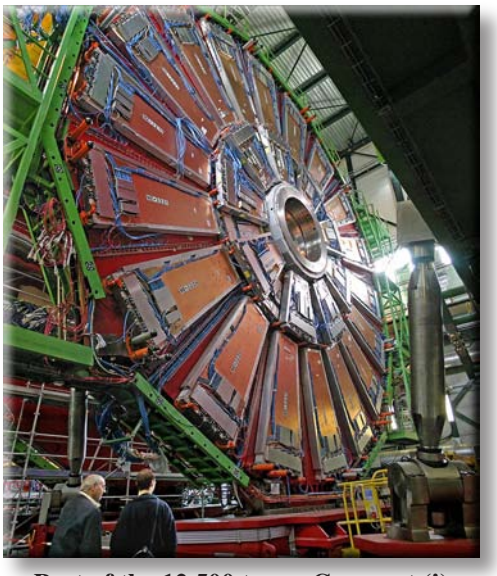
In October, four members of the SCI-FUN team working on our particle physics project (see below) travelled to Geneva to take part in the 50th anniversary celebrations at CERN. The site was opened up to the public, with unique access to the new detectors, currently under construction. (We also had the advantage that one of our group, Alan Walker, is a particle physicist at Edinburgh, currently engaged in joint experiments at CERN.)

Over the years, CERN has created a unique set of interlinked accelerators. These complex machines accelerate beams of particles, and let them collide to create high-energy conditions similar to those during the first instants of the Universe. Currently, CERN is preparing its most powerful machine yet, the Large Hadron Collider (LHC), in a ring of 27 kilometres circumference.

CERN's research at the frontiers of science also pushes back the boundaries of technology. Developments in areas from computing to materials science find broad applications in everyday life, thanks to an active technology transfer policy. (A brief sample: The World Wide Web originated here, and was offered free to the world; super-conducting magnet technology is routinely used in NMR scanners; ion and proton therapies have been developed for cancer treatment; ultra-high vacuum techniques look certain to revolutionise the development of flat-screen displays; and many more.)

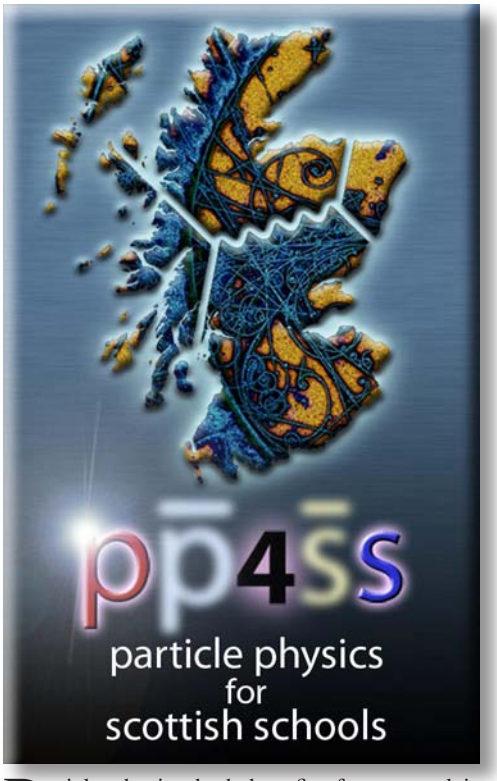
Finally, the collaborative aspect of CERN is noteworthy in itself: no one country could fund such research, and the unselfish cooperation of so many scientists and engineers is instructive (and inspiring!)

Visit our website to read more about our visit, and to see more images of the CERN accelerators, at www.scifun.ed.ac.uk/pages/pp4ss.html.



Part of the 12,500 tonne Compact (!) Muon Solenoid, being prepared for installation 100 m underground at CERN

Particle Physics for Scottish Schools



Particle physics both benefits from – and is hampered by – its glamorous reputation. While the ideas behind the subject seem mysterious and exciting (titanic machines used to probe the tiniest of particles and briefest of instants, recreating conditions that existed in the first fraction of a second of the universe), they can also be hard to understand, especially for younger pupils (or their parents!). The challenge is to bridge the gap, and open up the excitement of the field to such an audience – and all within SCI-FUN's budget...

To that end, the PP4SS project is taking shape as a series of experiments, forming the arc of a story in particle physics, to illustrate – with the use of hands-on exhibits, software packages and storyboards – how kilometre-wide accelerators are used as giant microscopes to probe the interior of atoms and particles.

From an initial series of simple exhibits showing the relationship between electricity and magnetism – and in particular the fact that a magnetic field can bend the path of charged particles such as electrons – pupils move on to apparatus which demonstrates the way in which magnetic fields can cause electrons to travel in a circle, letting them run their own 'mini-accelerator', and illustrating the principle of the larger CERN devices.

This leads directly to the next exhibit – a software simulation of the CERN LEP and LHC colliders – which allows the pupils to drive their own full-size accelerator: injecting particles into vacuum tubes; accelerating and guiding them with huge electric and magnetic fields to near light-speed and enormous energies; then smashing clusters of electrons and positrons (or protons and protons) together, generating temperatures and pressures similar to those at the beginning of the universe, and giving off sprays of exotic particles. And, just perhaps, they may discover the holy grail of particle physics: the Higgs Boson, which (we believe) gives all particles their mass, but which hasn't yet been detected. (The particle is named after Professor Peter Higgs of the University of Edinburgh, a theoretical physicist who predicted its existence in 1964.)

The pupil experimenters then leave the world of artificially accelerated particles, and move on to two exhibits which demonstrate the fact that we are surrounded (and permeated) by particles from outer space: cosmic rays, and the shattered debris of their collisions. First, is a *cosmic ray hodoscope* (to be built next year), which will show the paths of cosmic rays (highly energetic charged particles) as they flash through the apparatus, and us!

The final exhibit is a more subtle form of particle detector, one which can not only detect a particular kind of decay product (particles called *muons*) from cosmic ray collisions in the upper atmosphere, but can be used to show – as Einstein predicted in his paper on Special Relativity – that time slows down for objects moving near the speed of light, and that we can detect muons at the surface of the Earth only because their clocks are running much more slowly than ours!

The muon lifetime experiment takes us neatly into the preparations under way for next year's celebration of Einstein Year, marking the centenary of that extraordinary year in 1905 when Einstein published three seminal papers: on Brownian motion, which described (and made calculations on) the way in which tiny particles are moved around by impacts from individual atoms; the Photoelectric Effect, detailing the quantum (or wave packet) nature of light, which behaves as both wave and particle; and Special Relativity, in which bodies moving at near light speeds become more massive, and experience the slowing down of time. Not a bad year's work…

The mini-accelerator tube, muon lifetime experiment and accelerator simulator projects are currently under construction; PP4SS will be on the road at the start of next year.

Follow the progress of the PP4SS project at www.scifun.ed.ac.uk/pages/pp4ss.html.

Careers Information

In addition to the careers talk, which is part of our main roadshow, we are developing a new programme of workshops and interactive discussions about the importance of science in creating career opportunities and maintaining a wide choice of career options. Supporting material will also be available via an interactive careers website for pupils, parents and teachers. The careers session will be delivered by two members of our team around the time of the S1 & S2 standard grade course choices, and will be available initially to schools which have been unsuccessful in booking a SCI-FUN visit (although in time we plan to broaden its availability to a wider audience).

SCI-FUN's European Dimension

The University of Edinburgh is a member of the League of European Research Universities (LERU). Earlier this year eight LERU members put forward a proposal to the European Commission to fund a one-week 'Kids' University' for 10-12 year olds. If the proposal is successful, the event will take place during European Science Week (October-November) in the Year of Physics (2005) in each of the eight countries, and the UK event will be held at The University of Edinburgh.

The project coordinator, Professor Geoffrey Boulton, Vice Principal of the University with responsibility for the Public Understanding of Science, said "European Science week and Einstein Year will provide the opportunity to mount a very distinctive event in which the European dimension and interaction with other groups in Europe will play a key role. It will permit a particular focus on physics to be promoted and will engage the commitment of the University's School of Physics, the e-Science Centre, the Institute for Astronomy, the Centre for Science at Extreme Conditions and those areas of science that are underpinned by Physics-derived understanding, such as Earth and Planetary Science, and new areas of Biotechnology and Medicine."

Dorothy McMurrich, the project manager, has seized the opportunity for SCI-FUN to stage an expanded version of the regular events, reaching audiences in remote parts of Scotland and sharing experiences by video link with audiences across Europe. In the lead-up to the LERU Kids' University, schools which have hosted SCI-FUN will be invited to take part in a competition culminating in European Science Week with an exhibition of entries at the LERU Kids' University and the judging of the competition. As soon as we have further information about the Kids' University it will be posted on the SCI-FUN website.

SCI-FUN – School in focus: Peebles High

In this issue we're including an article by Lynda Cameron, an S6 pupil from Peebles High School, about our recent (and well received!) visit to her school. In future newsletters we'll print short pieces describing events of particular note from our travels around Scotland.

On the 7th and 8th of October, the SCI-FUN team visited Peebles High School. The event had been arranged at relatively short notice, but was very successful nonetheless. Many members of the school and wider local community had the opportunity to participate in the wide range of hands-on displays offered, which proved to be good fun, as well as a welcome change from our normal working environment.

The SCI-FUN team arrived on Thursday morning to set up the displays, helped by the school's Advanced Higher Physics class. Members of the Physics class enthusiastically manned the displays throughout the day, helping to explain the science behind the activities to younger pupils. The S1/2 students had lots of fun, and the science teachers seemed to appreciate the break from traditional teaching methods.

I took part in the roadshow as a "learner" during Thursday's last session. In Higher Biology class we had been learning about antigens, and were encouraged to look at the blood-type matching display. This brought an extra dimension to what we had learned in class; it's always good to see that something you know has applications in the real world.

On Thursday evening the roadshow was opened to pupils and parents from local primary schools. Wearing our uniforms, my friend and I stood at the door, welcoming visitors to the school, and pointing them towards the displays. Pupils (who had been issued with flyers at their local primary school) were eager with anticipation, while parents looked pleased to have a free way to entertain their children for a couple of hours. It was also a good opportunity for local children to see the High School before they have to come up for S1, which can be daunting.

We went first to the assembly hall to help with the exhibits. Children really enjoy hands-on science so it was very rewarding for us when they left one display in a hurry, eager to get to the next one. Chemistry, Biology and Physics were all represented, so there was something for everyone. I gained a lot from helping on the exhibits, as you can only be sure you've understood something if you can successfully explain it to someone else. Parents were also keen to learn, even if science has moved on a bit since they last studied it!

The talk we were given on meteorology was informative, and I was impressed that the scientist presenting it could interest people of all ages. Perhaps the most exciting part of the display was when he asked for a volunteer from the audience to try the Van de Graaf generator. Everybody's eyes went wide as they watched a girl's hair go wild with static, and after the end of the talk, parents and pupils alike were queuing to go on the machine. (The staff kindly obliged.)

For me, the most useful part of SCI-FUN was the opportunity to talk to the presenters, as they have all been students, and have been through the process of applying to university, which sixth year

Teamwork at Peebles High

pupils across the country are going through now. The people we talked to were able to tell us a little about courses, and seemed genuinely interested in our career aspirations. They were enthusiastic about science, and delighted to hear that our science department at school had persuaded more than a few of us to pursue science degrees.

SCI-FUN was a positive experience for both pupils and the school. With the general decline in popularity of science degrees, roadshows like this raise the profile of science amongst pupils, which I feel is important. And even if pupils choose not to continue their study of science after Standard Grade, they have at least had fun, and discovered that learning isn't all about books!

Thanks to Lynda for taking the time to write her article. It's abridged here, but the full account is at www.scifun.ed.ac.uk/misc/peebles.html.

For more information, or to book the Roadshow for your school, contact:

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