Takeaway Science
Science: from the lab to Second Life and across the world

Mike Bullivant
Welcome to takeaway science, yet another in the series of short podcasts produced by BLAST! at the Open University Science Faculty. This podcast comprises 3 more short audio sequences and later we talk with Dr Jonathan Hare, one of the presenters of the popular BBC2 Open University series, Rough Science, about the research he did for his PhD with Nobel prize winning chemist Professor Sir Harry Kroto. We also get to interview Sue Stocklmayer at the Australian National University in Canberra for an international perspective on science communication. But first we return to the subject of one of our earlier podcasts, the SCHOME project which uses the virtual world of Second Life to engage young people with science. In this sequence Becca Wilson a PhD student with the Open University's Planetary and Space Sciences Research Institute who's been closely involved with the SCHOME project, talks with some of the students who've been involved with building a satellite on Second Life.

Becca Wilson
I want to ask you how you feel about actually meeting each other in person.

Male 1
Yeah it's great and everyone's different to what I thought they would be like.

Male 2
I, er, I imagined everyone as avatars …. Not really a nut case?

Male 3
Cause we've all got on so well, at, over Second Life. I was quite worried that, that we wouldn't actually get on when we, er, all met face to face.

Male 4
To be honest, I, er, I don't personally see much difference but that's cause I'm kind of cynical.

Male 5
… too engrossed in your own virtual world anyway (Laughter)

Male 4
Everyone lives in a little world that revolves about a metre away from their heads.

Male 3
You can't really judge an avatar can you?

Male 5
You don't have 5 years of already knowing that person to drag you down or whatever, but you don't have, people have already formed a set judgment of you. They've got this time which they form the first judgment, you know, whether it's fair or not I don't know.

Male 2
… and by modifying posts you can change the, the way people see you…

Becca Wilson
What do you guys feel about, I mean, obviously the, the level of science that is required for this competition. Do you think that this is a very ambitious competition for people of your age?

Male 1
Well I think so yeah.

Male 4
Personally I don't think it's the science that's so difficult but the extent to which you, you run the calculations to apply the science to the particular situation.

Male 1
Yeah teamwork.

Male 4
Yeah the extent to which you've got to, um, go into depth on this one aspect whereas if you were just learning it then you'd, normally then you'd just learn the, the aspects, write it down maybe and then just go on to the next. Um.

Male 2
It's not very often teenagers get this opportunity to potentially send a satellite up to space so, um, if you're involved in the project, then you're going to put everything into it.

Becca Wilson
So, yeah, do you think you've been reading more science related things because of the competition?

Male 2
I certainly look through more journals and more, um, research articles

Male 3
Some of my teachers at school haven't even heard of earthshine, earthshine even so it's helped me a lot even if I don't understand all of it. The bits I do understand it's helped me enormously with.

Male 5
The material that I've covered in 'A' level chemistry has actually been applied to this. If someone's a little younger then they are going to have to go away and read about this for themselves and understand it.

Becca Wilson
Do you think then that the fact that we're trying to apply this to a real life situation, we've created our own real life situation here and we're trying to apply science that, as you said, you've accumulated during your education years.

Male 1
Me and Spiral did a presentation for Amir, well last week actually, um, and we actually said that learning things first hand does help you learn a lot really.

Female 1
It, it makes you want to study more because when you do science in a classroom it is literally just science, you really don't see any real life applications for it.

Male 6
And sometimes it's a bit boring as well.

Male 7
Um, one or two major advantages it's helped in the kind of blurring the distinction between science and engineering because it, it's more technical knowledge, it's not only knowing about kind of, um, how optics worked but what equipment you're going to use in order to elect you measure the spectre of kind of the moon and Earth and various other things.

Male 4
It, it's the application of physics that is different in the real world…

Becca Wilson
So would you, would you like to kind of see your schools, I suppose, having more links to your local universities, for example?

Male 7
I'd say definitely yes. Only one advantage of having the OU is it's obviously a nationally and internationally recognised university so having such a kind of large and, er, kind of prestigious organisation as the, um, Open University is kind of certainly advantageous.

Mike Bullivant
Have you ever wondered about the fundamental interactions that make the universe work or how the universe came to be as it is. Have you ever asked yourself how the universe may evolve in the future. Well the Open University course, "How the Universe Works" presents answers to these and other questions by introducing cosmology and particle physics at a level beyond the descriptive approach of many coffee table books on the subject. The course uses the results from cutting edge research to illustrate the science behind the media headlines. Specific topics covered in "How the Universe Works" include, the expansion of space, the cosmic microwave background radiation, atoms, nuclei, quarks and neutrinos, unified theories, dark matter and, believe it or not, 11 dimensional space-time. If you want to learn more about what this course entails log on to www.open.ac.uk/study. Now Emily Unell the BLAST! project manager recently attended a conference in Australia where she had the opportunity to talk with Sue Stocklmayer, Director of the Centre for Public Awareness of Science at the Australian National University in Canberra. Here's what Emily came back with.

Emily Unell
Sue, um, I understand that you've been involved with science communication for a number of years now, what, what do you enjoy about it?

Sue Stocklmayer
Variety. I think it's one of the best jobs because it really pulls in a whole range of things in which I'm interested. It pulls in theatre, it pulls in understanding how people think, er, it's ever changing as, as, er, perceptions about the relationship between science and the public change and I think that, er, I'm very lucky to work in this field because quite literally you never know what's coming next and my students are all doing amazingly varied projects for their PhDs and their Masters theses and so I get to look at a lot of things at that interface and I find that fascinating.

Emily Unell
Looking at the context for Australia, what do you think the main challenges are in terms of, of science in society?

Sue Stocklmayer
I think we have 2 challenges. The, the first challenge is that which is common to the countries of Europe, Britain included, which is to find ways of reaching the public effectively and we don't know much about that yet and we are looking at dialogue, we are looking at knowledge building but there isn't much around at the moment to serve as a model for doing it well. The second challenge in Australia is persuading our government – and we hope we'll have more luck with our new government – er, that this is an area which needs resourcing and funding because at the moment that is not the case. There's very little money given for public awareness of science, unlike Britain which is quite lucky in that regard I think. So those are the challenges here and, um, both of them are very daunting.

Emily Unell
What's the relationship between the centre here and the scientists at the university?

Sue Stocklmayer
Er, well we are part of the College of Science so we, we are located directly in the science area and that's very important. We insisted that that should be the case right from the beginning and, and I think that it's critical that any public awareness programme is in the science domain so we have a very good relationship with the scientists and we, we have some shared programmes with other science areas. We have a, a lot of science faculty who support strongly what we do, who take some pride in our outreach which is extensive, it's the major outreach area of the university and they, they think that's good for the college so they like that as well. So, yes we have a very good relationship and in terms of, er, expertise we, we boast that we have all these scientists at our disposal and we certainly use their expertise whenever, whenever we need to.

Emily Unell
Certainly in the UK the, the interface between science and society is can be fraught with all sorts of tensions and I wonder what you thought can be done to break down the barriers between science and society.

Sue Stocklmayer
I think it's very important that scientists themselves bridge that gap. I think as all the research shows it's not reasonable to expect the public to do that and so I think that the prime target should be scientists themselves and, and the organisations for which they work and, and in our case we do run workshops for scientists in how to communicate with the public. They earn an ANU award if they do the workshops and we've had very good responses from government organisations and, er, within the university itself but it is very much a small contribution and, um, I think it's fundamental that scientists in their original university education should have some training or, er, teaching about the issue of this gap because the gap is real and we still find there are may scientists who, who don't understand that gap and who just simply think it's a matter of, um, getting out there with the science and talking about it and it's a lot more than that and a lot more fundamental than that really.

Emily Unell
Um, so, I understand that your first degree was in physics and chemistry.

Sue Stocklmayer
Yes.

Emily Unell
Um, who is your hero or heroine of science?

Sue Stocklmayer
Well, it has to be a physicist-chemist doesn't it? [Laughter]

Emily Unell
It doesn't have to be.

Sue Stocklmayer
Er, the one person that if I were alive then I would be absolutely a Faraday groupie. Michael Faraday the first great communicator. I've actually had the privilege of standing there and touching that very bench that's in all the pictures and it was iconic for me to be in that room at the Royal Institution. Um, I think he was fantastic. He was a man for the 21st Century. He talked in words not formulae. He, he was not very interested in mathematics. He was a great communicator, a great demonstrator, a great inventor, a great innovator. Why wouldn't he be my hero? I think he's wonderful and the fact that he used to occasionally relax with Sarah and brew ginger wine in the lab and romp around the corridors I think just adds to his appeal.

Emily Unell
Absolutely. [Laughter]. Thank you very much for your time.

Sue Stocklmayer
Pleasure.

Mike Bullivant
Emily Unell talking there with Sue Stocklmayer, Director of the Centre for Public Awareness of Science at the Australian National University in Canberra. Now if you're the kind of person who's interested in contemporary issues with a scientific dimension, for example BSE, Variant CJD, near earth objects, water and well being, medicinal plants, climate change, nonetic manipulation and nano technology, then the Open University course, "Science in Context" is the one for you. "Science in Context" deals with the science behind all of these issues and its real world relevance. Each of these topics is analysed in terms of 4 themes, communication, risk, ethics and decision making. The course will equip you to examine critically similar issues that might arise in future. Be advised though that students on this course are assumed to have studied a range of scientific disciplines at level 1 and to have an interest in science in its broader social context. To find out more about the course or any Open University course in fact log on to www.open.ac.uk/study and follow the links to "Science in Context".
And finally, BLAST!'s David Smith gets to chew the fat with Dr Jonathan Hare, one of the presenters of the popular BBC2 Open University series, rough science. Now Jonathan is a physicist, inventor and science communicator but here he talks with David about the research he did for his PhD with Nobel prize winning chemist, Professor Sir Harry Kroto.

David Smith
Jonathan, can you explain more about your research?

Jonathan Hare
Er, yeah well a little sort of history. I did a physics degree at Surrey University and I wanted to do an astronomy PhD so I applied to Sussex, er, to the astronomy department and had a successful interview there, um, but it was mainly theoretical astronomy they were doing at Sussex, um, so they said, you know, you ought to apply to other universities. Well a couple of weeks later I had a phone call from Sussex again, but from Harry Kroto who was in chemistry and he was a spectroscopist and he was particularly interested in the molecules between the stars and the inter-stellar medium and he had a, he'd just a few years earlier discovered this beautiful football molecule C60, er, by accident trying to understand the chemistry in space. So he wanted a PhD student to, to investigate, er, some of this carbon chemistry in space. So initially, I, er, I said yes and I arrived at Sussex and my PhD programme was to try and understand carbon stars so these are stars that are pumping out large amounts of carbon into space and, er, so I was going to work on a, on a laser, er, a laboratory laser apparatus which would vaporise carbon and try and re-create the conditions of the carbon star but actually what happened was in the first year of my PhD, er, we found a way of making C60, er, in large quantities and I never did any of the laser stuff or the star stuff. I did a tiny bit with Harry on astronomy and we wrote a few papers together but basically my whole PhD then became a way of making C60, purifying it and finding out its properties.

David Smith
Whilst you were doing your research were you aware of how big this field would become?

Jonathan Hare
Well, of course when C60 was discovered in '85, um, people were very inspired by it because it's got this beautiful football structure, this caged structure but there was a lot of people who thought it was, wasn't true and it didn't have the caged structure, it had some other structure. Um, so that, that, both the inspirational side and the little group who didn't like it meant it generated a lot of interesting press, not only in chemistry but outside chemistry as well and science generally so there was a, a great excitement when suddenly we found a way of actually making gram quantities rather than sort of anagram quantities. So, yeah, it was incredible, I mean the, the field just blew up over a period of literally weeks. I found myself being one of the few people in the world who could make this stuff and, and purifying it and then we were giving it out to all the different experts who wanted to look at its properties. So it was a curious situation for a first year PhD to be in, um, because I was actually an equal with all these other professors in some respects. They couldn't make it, I could make it and we could make it in gram quantities or sub-gram quantities and I just was a coal miner,

making soot and C60 and giving it out to these various groups and travelling a bit and seeing all these, er, fascinating sides. But it was, it was also quite scary ‘cause I did my physics degree. I was quite confident in physics and going to a chemistry department was a bit, er, you know, having to catch up a lot because they talk slightly differently or start at a different level and then suddenly to meet all these experts, I was completely out of my depth all the time, you know, giving it to someone who’s doing circular dichroism, I didn’t even know what it was, you know, or someone else who was doing some very fine structure infra-red spectra, again I knew roughly what it was but I didn’t know any of the details so suddenly I was being introduced to all these experts. It was quite, almost slightly overwhelming, you know, exciting but overwhelming.

David Smith
And what do you think was the highlight of your research?

Jonathan Hare
It was fabulous to be involved with a really dynamic group, I mean, there was 5 or 6 of us in Harry’s group and we all shared in a very creative way the whole work so everyone had their own little expertise and it felt really wonderful to be part of a really dynamic group, um, and in the early days when I was one of the few people in the world who could make it and I was working through the night, I used to go into Harry’s office and on his desk would be the latest paper he was writing which we’d often discuss at lunchtime and I’d see from night to night how his thoughts were changing and how he was changing the writing of it and seeing the way his mind must work, I suppose at the height of his career and that was, for me personally, really exciting to see, seeing the thought processes as he was thinking and writing these things and transforming them into these great papers and then publishing them was amazing, to see that, cause usually you see the beginning and end but you don’t see all the process. And, of course, being involved with C60 and being one of the first people to make this thing was just magical dream really when I look back I can hardly believe that it happened but it did, it did, it was wonderful.

David Smith
So you have quite a substantial background in research, so why did you leave research to pursue science communication?

Jonathan Hare
Well I didn’t really want to. I’d worked in Harry’s group for 10 years so I did my PhD for 3 or 4 and then carried on for another 5 years or so and, er, I wanted to do both and for a while I, I tried to do research but really I was doing research part-time and science communication part-time. Well you can certainly do science communication part-time but it’s very difficult to do research part time and I just, what was happening the last few years I found I wasn’t really doing anything, I was being a lab manager and helping to organise stuff but I found it incredibly difficult to actually go into it and do research because you just need to be there all the time doing it. It’s really difficult to do hands-on practical chemistry-physics part-time. You could probably be an observer or something observational, er, but again you have to fit in with schedule of course. It’s really hard to do research part-time.

David Smith
So you’re probably still aware of the current climate around, um, C60 and nanotubes, do you have any ideas where the future lies with these?

Jonathan Hare
No, I mean from what I’ve heard the, they were sort of from 50-100 times stronger than steel but a sixth of the weight. Now it’s actually quite difficult to get one nanotube and hang weights on it to measure the, you know, they don’t do it directly, measuring these, these strengths so it’s difficult to know. But they are obviously exceptionally strong and light so one can see them being used to replace existing materials for making things, either as a fibre in a composite or alone if we can find some way of, of aligning them and growing them in very large quantities. So they, they are going to be useful, they conduct electricity and the way they conduct electricity is a function of the diameter, not so much the length, so you can fine tune the electrical properties by choosing the particular nanotube. So all those things you can see

would be useful in the future for doing stuff we already do but one can also imagine, well, it's hard to imagine, but you can envisage perhaps things that we can't think of now, er, fantastic little detectors where basically everything is designed into the nanotube by, by manipulating the shape and structure rather than getting a whole load of things and putting them together to make a complex device, you could grow a nano, out of carbon, a nano device which has all the properties for your little nano detector which are going to be presumably good for detecting, er, molecules, er, electro-magnetic radiation and all sorts of interesting, I mean, it's just a new Meccano set to make loads of things but I wouldn't like to look forward, er, and say exactly what it's going to be used for, I think they just, it's the start of something we, really promising, um. I noticed in the news recently someone's made a little nano radio out of single nanotube so it's the aerial, the detector and some kind of resonant amplifier as well all in one nanotube and it picks up FM radio, you know, that's pretty amazing.

David Smith
Jonathan, that, you're bringing up their common uses for nanotubes, um, do you think the environmental and health factors are going to impact greatly upon this?

Jonathan Hare
I don't know, I mean, there's a lot are scare over of nano technology as if it's some dreaded new thing and not really from scientists of course. It tends to be in the general media but, I mean, if you look at it really chemistry is all about nano technology really. They've given it a new buzz word but it is chemistry, it's not a new thing. But obviously you have to be careful with particles. We now know that, that, you know that builders, carpenters who've been breathing in dust and coal miners, you know, this is obviously not good for, for humans to breathe in, for living things to breathe in dust so we've got to be careful that these particles once they get into your lungs will cause irritation, um, but when they are as a composite, as a big thing, you know like a new bridge or new, I don't see why they should be any more dangerous than anything else, you know. They've used it in implants for, for mending bones together that were broken and they are extremely successful. There's no reason to assume that they are going to be negative. So, I, I think, as long as obviously when it's, as it's a fine particle you've got to be careful, just like you've got to be careful with any fine particle but I wouldn't have thought that, that these nano particles were any worse than anything else or any better than anything else.

Mike Bullivant
David Smith there talking with Dr Jonathan Hare of the Creative Science Centre which is based at the University of Sussex in Brighton. You know chemistry's of enormous importance in everyday life. Everything we are, see, make and eat is composed of molecules. The Open University course, "The Molecular World" offers a wide ranging introduction to chemistry and its applications and integrates the three main branches of chemistry, organic, inorganic and physical. The course covers the reactions of metals, the solid state, the shapes of molecules, thermodynamics and kinetics, the synthesis of organic compounds, structure determination by spectroscopic methods, bonding theory, periodic trends and the non metals and then multi-media materials are used extensively throughout the course to provide interactive teaching of key concepts. There are 9 short case studies that look at the chemistry behind topics of current interest, like polymers, batteries, catalysis, drug design, liquid crystals and forensic science. You can find out more about the molecular world or any other Open University course by visiting www.open.ac.uk/study and following the appropriate links. Well that's the end of this podcast brought to you by BLAST! at the Open University Science Faculty. For other podcasts in this Takeaway Science series re-visit the Open University Science Faculty website at www.open.ac.uk/science. If you want to find out more about some of the science outreach work carried out by the Open University visit the BLAST! web pages at blast.open.ac.uk. Anyway that's all for now, so from me, Mike Bullivant, adios amigos.