I, SCIENCE

THE SCIENCE MAGAZINE OF IMPERIAL COLLEGE

I, SCIENCE

EDITORS-IN-CHIEF
NICOLA GUTTRIDGE
DOUGLAS HEAVEN

THE SCIENCE MAGAZINE OF IMPERIAL COLLEGE

DEPUTY EDITOR
PETER LARKIN

DESIGN & LAYOUT
PETER LARKIN

EDITORIAL ASSISTANTS
SIOBHAN CHAN
VANNA BARBER

NEWS EDITOR
CONOR MCKEEVER

SUB-EDITORS
HELEN WILKES
LORNA STEWART
JULIA ROBINSON
JADE HOFFMAN
SAMUEL CAVENAGH

PROOFREADERS
CONOR MCKEEVER
KARIN VALENCIA
JULIA ROBINSON
MACIEJ MATUSZEWSKI
HELEN WILKES
MIMI LI
JOSH HOWGEGO
ALICE GOODYEAR
RAYNER SIMPSON

SOCIAL MEDIA
LUCY VAN DORP
SIOBHAN CHAN
VANNA BARBER

COVER DESIGN & ILLUSTRATIONS BY PETER LARKIN

I SCIENCE, FELIX OFFICE, BEIT QUADRANGLE, PRINCE CONSORT ROAD, LONDON, SW7 2BB

TEL: 020 7594 8072
EMAIL: I.SCIENCE@IMPERIAL.AC.UK

PRINTED BY:
BISHOPS PRINTERS, WALTON ROAD, PORTSMOUTH, HAMPSHIRE, PO6 1TR

I, SCIENCE

Approaching mid-September is bittersweet for this year's editorial team; we have now completed our MSc courses with the Science Communication Group, and will be leaving Imperial College for pastures new. It is fitting, then, that we go out with a bang – and bring you this issue entirely dedicated to science communication, its activities, aims, achievements, and all other facets of the field. We're also sad that this is our last instalment for the 2011-2012 academic year, but wish good luck to next year's editorial team in making their mark on the magazine, as we feel that we have done. It would not have been possible without the help from all of our writers, contributors, assistants, editors and proofreaders – so a big thank you to all who have lent us their time. We hope you've enjoyed this year's issues of *I, Science* magazine, and read on to enjoy this one!

NICOLA, DOUGLAS & PETER

This issue of *I, Science* is funded by the Wellcome Trust, in conjunction with the 21st birthday of Imperial College's MSc in Science Communication.

The Wellcome Trust is an independent global charity dedicated to achieving improvements in human and animal health. The Trust supports biomedical research, and work in the medical humanities. Their breadth of support includes public engagement, education and the application of research to improve health.

The trust was founded by Sir Henry Wellcome (1853-1936). A businessman, collector and philanthropist, he was born in the American Wild West but ended his days as a knight of the British Realm. Wellcome co-founded a multinational pharmaceutical company, and he invested his profits in collecting historical objects and funding pioneering medical research. After his death, Wellcome's will provided for the creation of the Wellcome Trust.

Today the Trust focuses its funding on three key areas of activity: supporting outstanding researchers, accelerating the application of research, and exploring medicine in historical and cultural contexts. Its research challenges pressing and fundamental problems that confront human and animal health. These research areas include maximising the health benefits of genetics and genomics, understanding factors that affect ageing and chronic disease, understanding the brain, combating infectious disease, and connecting environment, nutrition and health.

Written by Vanna Barber

Supported by wellcome trust

COVER FEATURE

SCIENCE COMMUNICATION

INTRODUCTION ON PAGE 9

CONTENTS

NEWS FROM *IMPERIAL COLLEGE*

NEW 35-STOREY IMPERIAL CAMPUS GETS GO-AHEAD

Imperial College has been given the green light by Hammersmith and Fulham council to build a new multi-use campus on a former BBC site in White City.

The planned development of the 20,000 square metre campus – dubbed Imperial West – forms phase two of the College's regeneration, which aims to provide more teaching, research and accommodation facilities to meet growing demand. In addition to 606 self-contained postgraduate flats, which form part of the first phase of development, the second phase of the Imperial West project includes plans for a hotel, sports and teaching facilities, an underground parking complex, and retail spaces.

With a broader aim of redeveloping the White City area, Imperial College has committed to putting £2.4 million towards the Crossrail project, and will invest a total of £8 million in improving the accessibility of the site, forging better transport links and providing open spaces for the community.

Current plans for the Imperial West development include a new nursery and educational links with local secondary schools as an ongoing part of Imperial's outreach programme. Imperial College, already a major employer in the borough due to its biomedical research centre at Hammersmith Hospital, is now expected to create an additional 3,200 permanent jobs on site with this campus.

But the proposal is receiving opposition from some of the local residents, who fear that the 35-storey campus will dominate the area's skyline and alter their community. The design, by Aukett Fitzroy Robinson and PLP Architecture, comprises seven buildings and a 141-metre tower that is set to be the tallest building in the borough.

Project director John Anderson says Imperial West "will improve the urban environment, visual appearance and access to a site which had been closed to the public for many decades." However, whilst Hammersmith and Fulham council have given their approval for the project, some residents believe the plans to be unlawful and have threatened the authorities with court action over their decision.

Construction of phase two is set to begin in early 2013 and, once complete, Imperial West will serve as a second major campus for Imperial College. ■

JADE HOFFMAN

IMPERIAL REAPS RESEARCH REWARDS AT ROYAL SOCIETY

At their Anniversary Day meeting in November, the Royal Society, Britain's most prestigious scientific institution, will award five Imperial College scientists with some of its most highly regarded medals, awards, and prizes.

This year the Council of the Society chose Emeritus Professors Tom Kibble FRS (Physics) and Andrew Holmes FRS (Chemistry) to receive one of three Royal Medals each. Kibble will receive an award for his work in the 1960s that led to the now almost-discovered Higgs boson, while Holmes will receive his for contributions to polymer chemistry and organic plastic electronics.

Professor Jenny Nelson (Physics) won the Royal Society Armourers and Brasiers' Company Prize for her work in materials research for organic plastic electronics and low-cost solar cells. Professor Roy Taylor (Physics) received the Rumford Medal for his groundbreaking research into lasers and fibre optics. Finally, Professor Molly Stevens was awarded a prize following her 2012 Clifford Patterson Lecture titled 'Regenerating organs and other small challenges'. ■

JULIE GOULD

IMPERIAL SCIENTIST JOINS MARS EXPLORATION MISSION

An Imperial geologist is one of only two British researchers collaborating on NASA's Mars Science Laboratory project, which successfully landed the rover Curiosity on the red planet's surface in early August. Professor Sanjeev Gupta joins John Bridges from the University of Leicester's Space Research Centre as part of a 200-strong international team that will analyse the data sent back by the mission.

The size of a small car, Curiosity is the largest rover that has ever been sent to Mars. It carries some 75 kilograms of scientific instruments, which will allow it to study the geology and chemistry of the planet in greater detail than ever before. Its landing site, the Gale Crater, is geologically significant, with Gupta believing that it might have once held a lake. This might have made it an ideal location for life to develop, and the mission's main goal is to look for evidence that conditions hospitable to living organisms might once have existed there.

Gupta has previously studied Mars – his groundbreaking analysis of satellite imagery of its surface suggested that liquid water might have existed there as recently as three billion years ago, far later than had previously been believed. He will spend some of the mission's 98-week duration at the Jet Propulsion Laboratory in California where he and his colleagues will turn their talents to producing a geological map of the area surrounding the landing site. ■

MACIEJ MATUSZEWSKI

ANTI-DOPING LAB REPURPOSED FOR RESEARCH INTO DISEASE TREATMENT

Following an Olympic Games, many custom-built facilities are left to gather dust. However, no such fate awaits the London 2012 anti-doping headquarters in Harlow, Essex, which is already guaranteed a bright future.

The site will be developed into the MRC-NIHR Phenome Centre, and is set to open in January 2013. Led by Imperial professor and future director Jeremy Nicholson, the biomedical centre will house an Imperial-led academic group that aims to explore the characteristics of disease in order to develop more targeted and effective treatment.

At present, the facility – provided by GlaxoSmithKline and operated by King's College London – analyses up to 400 urine and blood samples a day, searching for over 240 prohibited substances. A £10 million investment from the Medical Research Council (MRC) and the National Institute for Health Research (NIHR) will enable the lab to be developed and repurposed after the Games have ended.

A 'phenome' describes the entire mixture of molecules in the body, found in our bodily fluids and tissues. By analysing a patient's metabolic products, the centre aims to profile a person's biology according to not just their DNA, but the interactions between their genes and the environment.

"Metabolic profiling will give us a new dimension of understanding about the factors that contribute to disease," says Professor Jeremy Nicholson. It may also provide us with "crucial information for predicting how individual patients are likely to respond to treatment".

Researchers will look for 'biomarkers' in cells, molecules and genes, which may help to explain why certain individuals are more susceptible to disease than others. Ultimately this knowledge will enable scientists to create safer and more targeted treatments which, according to Chief Medical Officer Dame Sally Davies, may offer "the potential to revolutionise the way we treat a wide range of diseases". ■

ALEX GWYTHER

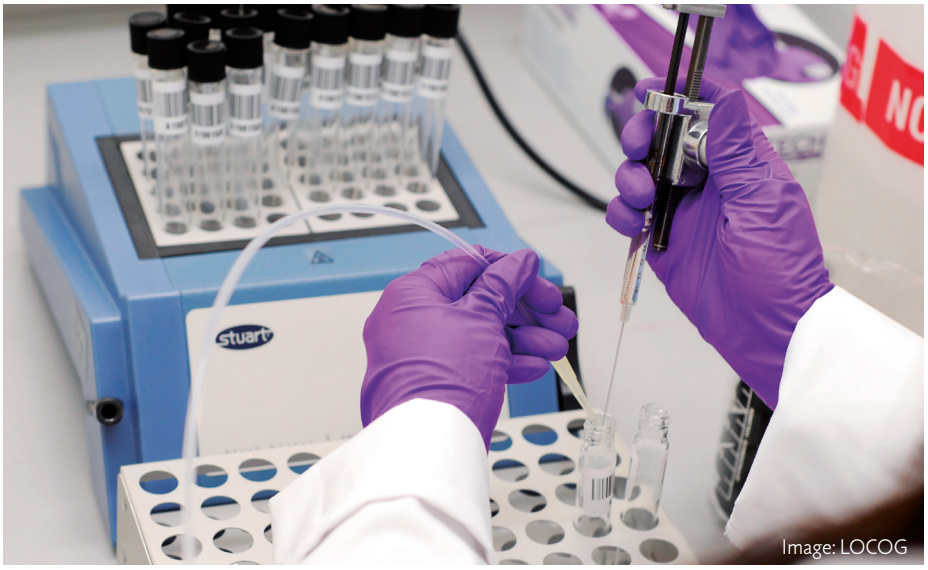


Image: LOCOG

WORLD NEWS

PICK OF THE BEST

Image: Andy Welsh / CC-BY-SA-2.0

NEW STUDY SHOWS CARBON SINK ABSORPTION HAS DOUBLED

A recent study has shown that the amount of carbon dioxide being absorbed by the planet has doubled in the last 50 years. The study contradicts theories predicting that carbon absorption by natural sinks is in steady decline.

Each year, humanity adds roughly six billion tonnes of carbon to the Earth's natural carbon cycle. Currently, around half of this excess carbon is absorbed by natural systems that store CO_2 from the atmosphere. These "sinks" comprise mainly of plants, trees and the Earth's oceans. Many previous studies have suggested that during the 21st century, as deforestation and ocean acidification continue to occur, the ability of the planet's carbon sinks to absorb excess carbon will decrease.

Scientists at the University of Colorado found that between 1960 and 2010, the volume of carbon being absorbed from the Earth's atmosphere by natural carbon sinks has increased by around 50%. The team constructed a mass balance model to map the movement of carbon in the carbon cycle. The model combined atmospheric CO_2 concentrations with historical data on carbon emissions from both fossil fuel usage and land development. Analysis showed that the net global carbon uptake by carbon sinks rose by around 0.05 billion tonnes of carbon per year.

This recent work is likely to have a huge impact upon the way scientists forecast future atmospheric carbon levels and the extent to which carbon emissions are expected to contribute to global warming. These results may well represent a short-term reprieve in the battle to limit the potentially disastrous effects of global warming. However, since it is widely accepted that this level of carbon uptake will not continue indefinitely, global warming is not likely to disappear from the agenda anytime soon.

JENNY MITCHELL

MOLLY DOCHERTY

PROSTATE CANCER SCREENING DILEMMA

Controversy surrounds a blood test for prostate cancer, which some claim leads to unnecessary and harmful treatment for an otherwise non-aggressive disease. Now research published in CANCER shows that the test in fact resulted in a 67% drop in presentations of metastatic (spreading) prostate cancer. Critics have called for research into the effects on health outcomes, not simply early-detection rates.

CHINESE LUNAR ROVER PLANNED FOR 2013

LAURENCE POPE

China will attempt to land an exploratory craft, Chang'e-3, on the surface of the Moon in the latter half of 2013. If successful, Chang'e-3 will be China's first lunar rover as well as the first lunar probe to undergo a soft landing in over thirty-five years.

Chang'e-3, named after the Chinese Goddess of the Moon, is part of the second phase of the three-phase Chinese Lunar Exploration Program. This follows the successes of the unmanned orbital mission probes Chang'e-1 and Chang'e-2, launched in 2007 and 2010 respectively. Chang'e-3 will collect and transmit data for 3 months from a limited lunar area and, if successful, will be followed up by a lunar sample return mission in 2017.

The Chang'e missions are not the only ones undertaken by China's National Space Administration. The launch of the unmanned Shenzhou-1 spacecraft in 1999 sparked off China's space program, and since then China has sent eight men and women into space and undertaken space walks. This makes China only the third country after the US and the former Soviet Union to independently launch humans into space.

The ultimate goal of the Chang'e missions is to land a man on the Moon by approximately 2025-2030. The last manned Moon landing was carried out by the astronauts of Apollo 17 in 1972.

WILD FISH FOUND WITH SKIN CANCER

Skin cancer is known to affect a range of animals, and now the disease has even been found in fish. Previous work has shown that hammerhead sharks 'tan' black in the sun, and swordtail fish can develop melanomas in the laboratory when exposed to ultraviolet light. New research published in PLoS ONE is the first to identify wild fish suffering from skin cancer.

Scientists from Newcastle University and the Australian Institute of Marine Science sampled a coral trout population in Australia's Great Barrier Reef. From 136 fish analysed, 20 (15%) displayed skin lesions characteristic of melanoma. All were early-stage cancers not affecting general health. However, fitness is impaired as the disease progresses which might have prevented fish from feeding and being line-caught for study. As a result the team predicted the true prevalence of the disease to be even greater than 15%.

The area's ozone hole could be responsible, and the discovery may have implications for the Great Barrier Reef and the fisheries that exploit it. To understand the extent of these implications, scientists must now sample wider fish populations and analyse coral trout DNA for mutations that could render it especially susceptible to the sun's rays. ■

MOLLY DOCHERTY

TOUCHDOWN CONFIRMED! CURIOSITY ROVER LANDS ON MARS

CONOR MCKEEVER

Eight months and 567 million km since it launched from Cape Canaveral, NASA's Curiosity rover landed successfully in Gale Crater, marking the beginning of its 98-week mission to discover if Mars could have ever hosted life.

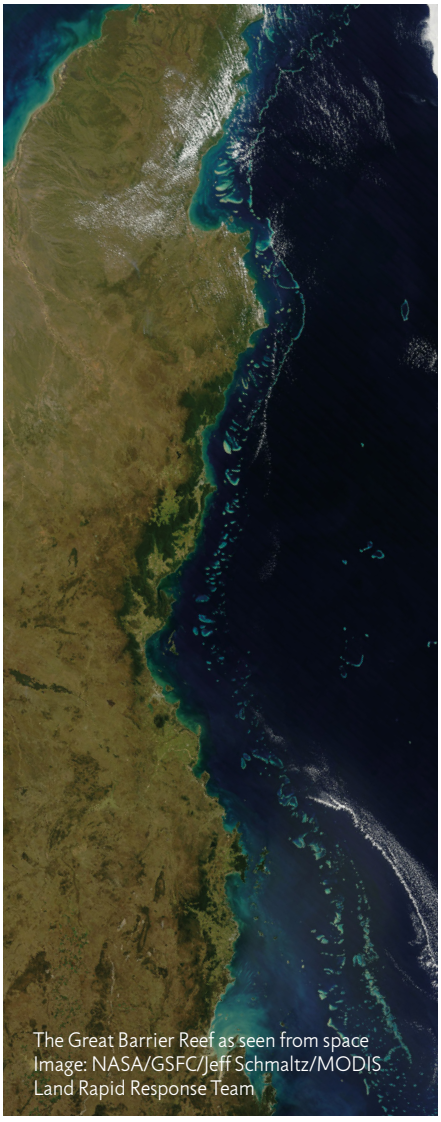
The landing, billed as 'seven minutes of terror', was NASA's most ambitious to date. Upon entering the atmosphere, an 18-metre-wide parachute slowed the rover from 21,200 kilometres per hour to just 1,700, before a 'skycrane' – a separate platform held up by rockets – ejected from the external shell and lowered the rover to the surface on nylon tethers. The whole descent was automated, as the 14-minute radio delay between Earth and Mars made any last-minute adjustments impossible.

After undergoing tests to ensure everything is in good working order, Curiosity will leave the landing site and its mission will begin in earnest. Its eventual destination is Aeolis Mons, a mountain 6.5 km away, composed of layers of sediment laid down when Mars had liquid water on its surface. These layers form a record of billions of years of geological history, allowing the rover to look for evidence of water and organic compounds – two conditions necessary for life as we know it.

To achieve this, Curiosity will use a combination of a high-resolution camera, to detect objects of interest at a distance, and a range of scientific equipment, to analyse the items found in more detail. It can determine the elemental composition of nearby rocks by vaporising a small amount with a laser, then analysing the light given off using a spectroscope. If the feature requires further analysis, instruments for X-ray diffraction, mass spectrometry and gas chromatography can determine the structure of samples collected with the rover's mechanical arm.

> "THE LANDING, BILLED AS 'SEVEN MINUTES OF TERROR', WAS NASA'S MOST AMBITIOUS TO DATE."

Whether Curiosity discovers the building blocks of life or not, the next two years are sure to be tremendously valuable: the rover is the most advanced ever sent to Mars, and by measuring radiation levels and atmospheric conditions, it could pave the way for manned missions in the future. ■



The Great Barrier Reef as seen from space
Image: NASA/GSFC/Jeff Schmaltz/MODIS Land Rapid Response Team

MICROSOFT ANNOUNCES HOTMAIL REPLACEMENT

July 31st saw Microsoft announcing the Outlook.com email service – the future replacement for Hotmail. A notable part is its Metro interface, currently only a preview and also seen on Windows 8. Outlook.com also contains new calendar and contacts features, plus an updated SkyDrive. Microsoft highlighted the improved privacy aspects of the service but as yet did not specify when it would leave the preview phase. ■

PHILIP KENT

Imperial Festival

The inaugural Imperial College festival was held on 11th and 12th May 2012, featuring 'zany' inventors, a 19th century quack and a silent disco. ***Helen Wilkes*** *chats to* ***Harriet Martin*** *from Imperial's Communications and Development department on why the festival was created, what its aims were and what it means for Imperial College's science outreach.*

WHAT WAS THE MOTIVATION BEHIND THE IMPERIAL FESTIVAL?

The idea was born out of a desire to engage people, institutions and organisations outside of College with the myriad accomplishments and activities of staff and students at Imperial. It grew out of a review into the membership and purpose of the College Court – a selected group of Imperial stakeholders – and evolved into a much bigger event to celebrate and showcase our work, with elements dedicated to the Court and the Alumni Reunion, as well as general public audiences.

The Festival soon took on a life of its own – creating an opportunity to establish a positive relationship with the outside world, develop and enable good practice in public engagement and attract broad and diverse adult and family public audiences. This was our chance to show the world what we could do, and increase our visibility and engagement through innovative and engaging activities from our students and researchers.

DO YOU THINK THE FESTIVAL WAS A SUCCESS? WHAT WERE THE OUTCOMES YOU WANTED TO ACHIEVE?

Yes – wherever you looked during the event, people of all generations were enjoying themselves. Reactions on the day and an external evaluation both provided further glowing feedback, which we were very pleased with.

When we began planning it, we identified four key aims for the Festival: 1) Showcase the work of Imperial and celebrate its achievements. 2) Further public engagement across all departments and levels. 3) Empower key stakeholders, including Council, Court, alumni, local communities and both adult and family public audiences 4). Generate a sense of pride from staff, students and the broader College community.

We feel these were achieved across the board, with some other exciting outcomes as well.

In the marquee, several researchers were able to make connections with other departments and foster new collaborations across the College. From a researcher who ran a stand in the Research Zone: "I have met a few researchers from different departments and shared some ideas, collaborations can be established. The Festival has been a very fruitful occasion for networking."

HOW MANY PEOPLE ATTENDED – WAS THIS MORE OR LESS THAN YOU HAD HOPED? WHAT SORT OF PEOPLE CAME TO THE FESTIVAL?

This is never an exact science as we weren't using counters, and there were many drop-in visitors whose dwell time was hard to calculate. However, after a look at remaining programme numbers, and head counts in talks, the marquee and

throughout the day we've estimated that approximately 7,000 visitors came to the Festival over the two days.

It was also very difficult to know what to expect as this was the first ever public event of this scale at the College, and we have very little information regarding the type of visitors that might be attracted to the event. Given that this was, in many ways, a stab in the dark, we were very pleased with this number, and especially by the wide range of students, staff, alumni and members of the public that made up the audience.

We were hoping to attract an adult audience on the Friday, modelling the event after the highly successful Science Museum Lates events and other adult programmes from cultural institutions. On Saturday, the programme was geared more towards alumni and families, and we were thrilled that each group attended and found different aspects of the Festival to suit their tastes.

WHAT WAS THE PURPOSE OF THE FESTIVAL IN TERMS OF IMPERIAL'S OUTREACH ACTIVITIES?

The outreach objectives of the Festival really focused on making Imperial an accessible and interesting destination for local residents, businesses, visitors, current and returning staff and students, so pretty much everyone! We wanted to strengthen the relationships that Imperial has with all stakeholders and create a wider awareness towards the research we do, as well as some of our extra-curricular activities such as dancing and music.

Over 200 researchers took part in the Research Zone in the marquee over the weekend, many of them talking to the public for the first time. The Festival provided a great opportunity for our researchers and students to get some hands-on experience in engaging with the public – something we hope they will take with them to future events both here and elsewhere.

Finally, the Festival gave us another way of putting Imperial on the map and really celebrating what makes the College so unique. With all the local museums and attractions around us in SW7, it's easy for the public to forget that there is a powerhouse of fascinating research and talent nestled behind our doors. This is our chance to invite people in to see for themselves what goes on, and for our staff and students to show their family, friends and the wider public what makes them tick.

WHAT WERE THE STANDOUT MOMENTS OF THE FESTIVAL?

It's so hard to pick one or two 'bests' as to me what made the Festival a success was the range of activities and performers, dance and discussion, talks, demos and music, all sitting side by side. I've pulled out a few quotes:

"It's happy and young and cheerful and lively…it's very chilled and I like that there is no gate and you can just walk in, participate and wander around." (Member of the Festival public)

"The highlights were that this festival was designed to attract the general public. I think it's a great idea that we have an event that encourages the public to meet the researchers who are carrying out work which will be of great benefit to them and industry." (Member of Imperial staff)

"For us the highlights were the interactive, hands-on things because they show you how science works and you can take part in it." (Mother visiting in family groups with two primary school age children)

WHAT HAPPENS NOW – WILL THERE BE ANOTHER IMPERIAL FESTIVAL? WHAT HAVE YOU LEARNT FROM THIS FESTIVAL?

Absolutely! The Festival will continue in 2013 (Friday 10th and Saturday 11th May) and our aim is to make it even bigger and better.

In addition, we have launched a new stream of public events, the Imperial Fringe, which will be evening events to provide unexpected insights into the research we do here at Imperial. These will take place on the last Thursday of each month during term-time and kick off with a Halloween spectacular from 6-9pm on Thursday 25th October in the College Main Entrance. There will be zombie outbreaks, a sleeping patient, brains, robots and more…

For more information about the Festival and Fringe check out the website www.imperial.ac.uk/festival or email festival@imperial.ac.uk

Science communication is not just a segregated department in a university. Neither is public engagement a completely separate unit. All these activities need to work together to best benefit a university community. Although Imperial College has the Science Communication Group, we feel that this has a valuable place in the wider university and local community – something that is the overarching theme of this 'Science Communication' issue. With this in mind, we asked Imperial's Rector, Sir Keith O'Nions, to say a few words about what science communication means to him, and what it means for Imperial College as a whole.

– Nicola & Douglas
Editors of *I, Science*

A Letter from the Rector

Science communication in the modern age comes in many forms, and we have travelled a long way from the days when the only reliable source of science information was *Tomorrow's World* on the BBC. Today, we as science communicators have a plethora of channels with which to engage audiences and highlight our work. From Twitter, Facebook and YouTube to podcasts, blogs, live events, TV and radio, never have we had so many ways to talk about what we do. Yet it is the printed form which allows for a longer dissection and discussion of a subject, allowing the reader to get beneath the surface of a topic in a way that would be impossible in 140 characters.

So it is a particular pleasure to write in support of this special 'science communication' issue, which is gratefully funded by the Wellcome Trust, and which is published to coincide with the 21st birthday of the Imperial College Science Communication Group in September 2012.

The many great discoveries which are happening every day within the labs, wards and workshops of Imperial College will be of little benefit if they are not communicated to the wider world. How else will those discoveries advance the frontiers of science and technology across the globe, helping to tackle the many great challenges which we, as a society, face? As academics and researchers, we have a duty to communicate the benefits of our knowledge and findings to a wider audience. We have a pivotal role to play in policy formation, supporting decision-makers in areas such as climate change, energy security and global health, and who will make choices which will affect us all.

This is the reason why publications such as *I, Science* are important. I commend all those who have contributed to the magazine, and to the Science Communication Group for their excellent work in amplifying the College's mission to communicate the impact of our education, research and translation activities. ■

KEITH O'NIONS
President & Rector

Thanks also to Bethan Parry for her assistance with this piece.


PRESS
"public"
journalism
ence
nmunication
dialogue
policy
engagement
upstream
exhibitions
broadcast
down stream
Peter Larkin

SCIENCE COMMUNICATION COMES OF

***Stephen Webster**, senior lecturer and head of Imperial College's Science Communication Group, reflects on the past 21 years of Imperial College's MSc in Science Communication*

In October 2012 the latest cohort of students arrives to study on Imperial's MSc in Science Communication. There will be around 50 of them, and because they are the 21st cohort, I can't help thinking that we've come of age. We have 600 alumni by now, and you'll find them pretty much everywhere you look: in the media, in science publishing, in museums and in charities.

A 21st anniversary deserves a celebration. But beyond giving ourselves a big pat on the back, this is a good moment to think back over the years. I have two questions to ponder. First, what are the values of the course that we might want to protect as the foundation for our next period of office? Second, just as broadly, how has science communication been affected by the cultural changes of the last two decades?

Let's be clear about the values of the course. We want our students to have technical skills that will be of immediate utility on leaving Imperial. We group our practical teaching into five categories: TV and film, radio and audio, writing, exhibition development, and web design. When our students have finished their practical projects (and sometimes before), they have a set of tested skills that will impress an employer. As with science itself, there is more to the good science communication student than technical skill. You need to be able to think critically too. The MSc programme is filled with study therefore. Once levered open by the enquiring mind, science fizzes with philosophical and cultural concerns. And in trying to understand relations between science and society, our students encounter many disciplines. To make progress, they don't simply increase their reading (although we do have long reading lists). They begin to debate.

When the students arrive in October they start talking as though they've never talked before. It would be crazy to have a science communication course that wasn't dominated by, well, communication. We believe that the successful science communication student is someone who combines serious technical skills with a lively and critical interest in the intellectual agenda.

I can sum all this up by suggesting that the university course that has longevity is the one where there is a clear philosophy. In our case too we have been consistently supported by friends within Imperial College, and outside. I can single out the Wellcome Trust, who support us with bursaries and have funded our anniversary conference. And there are many industry professionals – often they are alumni – who come in to give seminars, help with teaching, and keep life sweet.

> HELPING SCIE
> BALANCE BETW
> AND THE LOUD M
> COMMUNICA
> IMPORTA

F AGE AT IMPERIAL COLLEGE

There is a wider reason for our longevity: the sustained need for our graduates. The factors at play when science becomes public seem more complex than 20 years ago. We can see this by looking at the classic landmarks of the science communication landscape. A turning point was the Royal Society report of 1985 that asked scientists to be more active in explaining their work to the public. What has followed in the years since is a long series of upheavals showing that explanation is not enough. Cultural understanding is needed too. The Chernobyl nuclear explosion of 1986; public resistance to GM technologies; confusion over the lethality to humans of mad cow disease (BSE); upsets with the MMR vaccine; the Fukushima incident: these case studies show the difficulty of planning the 'social trajectory' of hoped-for scientific advances. The successful passage of the Tissues and Embryos bill of 2009, and the Human Fertilisation and Embryo Authority's 2012 announcement of public consultations on mitochondrial transfer, are typical of a new approach. These enquiries, taking place before a technique simply lands on our lap, elaborate public ambivalence about technology, and find common ground. Our alumni are contributing to this work.

> ENCE FIND ITS
> EEN THE QUIET
> MAY BE SCIENCE
> TION'S MOST
> ANT ROLE

I'll end by sounding my own note of ambivalence. I worry that science communication is helping turn science 'inside out'. We should consider carefully before we let the public face of science take priority over its private face. Physicists demonstrated in May 2012 outside Downing Street with a coffin – among their concerns was that the 'impact agenda' of the funding councils, with its renewed call for research to show economic gain, hits against pure science. For these scientists, the coffin was a symbol of the death of a kind of science, but I think we can take it too as a symbol of the death of scientific privacy, of a particular ideal where people work for a long time on an idea in security and in freedom.

Science communication is implicated here. As an activity it feeds a vast and busy media culture, and benefits too from the insecurity of modern institutions, which grow ever more interested in transparency and public engagement. Yet science communication is far from being only a form of publicity; it is also a space for reflection, to be occupied by scientists, arts and media professionals, academic analysts, and other members of the public. Helping science find its balance between the quiet and the loud may be science communication's most important role. ■

Stephen Webster is head of Imperial College's Science Communication Group, in which he is a senior lecturer. Imperial College's Science Communication Group are holding a celebration for their 21st birthday on 13th September.

"NO 'ONE SIZE FITS ALL' IN TERMS OF HOW A UNI

***Nicola Guttridge** and **Douglas Heaven** chat to public engagement staff from Imperial College London, University College London and Queen Mary, University of London to see if they approach their activities in different ways – and what they hope to achieve.*

Anyone reading this with a scientific background probably doesn't need to be convinced of science's worth. But when universities need to spread the word about their research, they must engage a non-scientific public, as well as partners and funders, to convince them too of its benefits. Some universities tackle this by setting up specialised offices to handle public engagement (PE) on behalf of their scientists. Imperial College does not yet have its own unit, but employs staff dedicated to these challenges. University College London (UCL) and Queen Mary (QMUL) have set up PE centres.

"When I started I was the only person at a London university dedicated to supporting this kind of work," says Steve Cross, head of the public engagement unit at UCL. "But now nearly all of the major London Universities – Imperial as well – have staff just like me." Cross has worked in public engagement for four years. He aims to support activities that "encourage a culture of two-way conversations between university staff and students, and people outside the university."

This is the essence of PE, so it is unsurprising that Imperial, UCL and QMUL all have a similar philosophy. What is somewhat unexpected is the speed with which more dedicated public engagement units are springing up. "We recently created a new academic centre for public engagement," says Peter McOwan, head of PE activities at QMUL. "We want to bring together the various projects already in existence, help spread the practice both internally and externally, and to support and mentor the next generation."

McOwan and QMUL have a strong sense of social responsibility, and take great pride in the university's beginnings and continued activities in the local community around their Mile End campus in East London. "Queen Mary began life as the People's Palace, a philanthropic centre bringing education and culture to people living in the impoverished, often ignored, East End," explains McOwan. "125 years on, although the area still faces significant social challenges, it is transformed – and in this Olympic year, the focus of the world's spotlight."

Imperial also aims to engage its local community in what they do. "Given our location in the heart of South Kensington's cultural institutions, we are keen to develop more collaboration with our neighbours," says Natasha Martineau, Head of Research Communications at Imperial College. She highlights the recent Imperial Festival *(see Helen Wilkes' interview on page 7)* as a good example: "We were pleased to get a contribution from every department and institute at the inaugural Festival in May 2012," she says. "This suggests that our community is keen to take up these opportunities!"

Martineau finds herself adapting her approach to PE at Imperial depending on the department and institute. "It is clear that no one size fits all in terms of how a university can best support its community in engaging with the public," she says. "The path for medics may be very different than that for physicists."

However, in some ways, there is a limited amount that PE units can do. Motivated and public-aware scientists ultimately control the amount of coverage their department and research can get – Cross mentions, for example, how his unit spends approximately twice the amount of time on engagement for STEM as for humanities and social sciences. Why does he think this is?

"We work with Scandinavian Studies a lot, German less so, Neuroscience all the time, Genetics quite rarely, for example," he says. "Under-representation for us tends to be a product of individual personalities within departments and their desire to engage with publics, rather than the subjects themselves."

UCL deals with a wide range of social sciences, arts, humanities, law and STEM subjects, so it makes sense that some subjects may lend themselves more readily to PE. At Imperial, a notoriously science-dominated institution, Martineau finds that it is this narrow range of subjects that helps to give focus to the university's PE activities. "I've only ever worked in science-based institutions, so I may not be in the best place to make a proper comparison," says Martineau. "But the more we develop our support in this area, the more I am aware of how public engagement can make tangible differences to the paths of research. So in that sense, I would say that the [science] focus is very helpful."

> "PUBLIC ENGAGEMENT CAN MAKE TANGIBLE DIFFERENCES TO THE PATHS OF RESEARCH"

Like UCL, QMUL also has a mix of humanities, social sciences and STEM subjects across its courses. But their approach is slightly different to UCL's, in that they mix together the various PE topics to strengthen their effect. "At QMUL we have a healthy balance of [humanities and sciences]," says McOwan. "What we are interested in doing is looking for ways that these two branches can usefully work together to create exciting new ways to engage the public in an interdisciplinary format."

So, what's changed in the sector since the officers have been working within it? "I've been working in this style of public engagement, as opposed to more traditional science communication, for four years," says Cross. "The big changes have come from the funders of research." Both Martineau and McOwan agree with Cross on this point, mentioning how PE has gained in importance and profile over the years. They both note how the impact of their activities is now considered in research proposals. "Research councils expect more from researchers in these areas now," says McOwan.

All the universities hope the field will continue to evolve and improve. "For Imperial things have so far focused quite strongly on embedding PE within the life of a researcher," says Martineau. "I'd like to develop a similar momentum for supporting it in our teaching and with our students."

At UCL, Cross feels exactly the same way. "Public engagement with research is a well-established field," he says. "But it's not yet clear what this engagement will look like as it becomes part of teaching, learning and other university functions." ■

SCIENCE BEHIND THE PHOTO

Although seemingly beautiful and serene, this fiery image shows the hundreds of millions of stars at the turbulent heart of the Milky Way, all cocooned in cosmic gas and dust. The life of such a star is visible in its entirety, from the dusty regions of star birth, populations of young stars, ageing stars, old stars, and dead stars, to their remnants. All of this chaos is permeated with a hazy blue light, the product of X-ray outflows from black holes and massive stars.

Released back in 2009, the panorama is a composite of images from the Hubble Space Telescope, the Spitzer Space Telescope, and the Chandra X-ray Observatory. It played a part in the International Year of Astronomy (IYA), a global celebration of astronomy and its contributions to our society and culture.

The IYA was held in 2009, 400 years after Galileo first blinked up at the skies through a telescope – a moment often lauded as the birth of modern astronomy. Copies of this image were printed and unveiled by NASA across more than 150 sites – including planetariums, museums, and libraries – across the US, showing how involved the organisation is in public engagement and communication. Hubble's ability to go beyond gathering data for scientists to study has proved to be a real bonus for igniting the public's interest in astronomy.

Astronomy is a highly collaborative field – partially by necessity. Sharing time on the world's largest telescopes requires high levels of co-operation, as does observing the same phenomena from various parts of the globe. It also has the ability to bring countries together – although the recent landing of the Mars Science Laboratory on Mars was a NASA effort, underneath it all was the uniting achievement that Earth had successfully sent a probe to another planet. ■

IMAGE: NASA, ESA, SSC, CXC, AND STSCI
WORDS: NICOLA GUTTRIDGE

WHAT IS ALL THIS SCIENCE JOURNALISM FOR?

***Felicity Mellor** explores whether science journalism aims to inform, educate, or evoke an emotional response.*

At the time the first students were arriving to study on Imperial College's new MSc in Science Communication, the newspapers were carrying a variety of science stories – new measurements of the wobble of the Earth's axis, the challenges of breeding pandas in captivity, a malfunction with the spacecraft Galileo, the identification of a gene associated with Alzheimer's disease. 21 years on, and any day will find a similarly eclectic sample of science stories hitting the news. Why? What is all this science journalism for?

Speaking at the UK Conference of Science Journalists this summer, Evan Davis, presenter of Radio 4's *Today* programme and former economics editor at the BBC, suggested that the role of science journalists was to explain the subject so that readers – or viewers or listeners – could make up their own minds.

This suggests that the audience does something with the information they receive. For Davis's economics beat, that makes sense. The economy is often the main focus of election campaigns, so understanding economic developments may influence our political choices. Similarly, news reports about financial issues can influence the decisions we make about our own finances.

But what do we do with the information that the Earth wobbles a little less than had been thought, or with the news that the Higgs boson has been sighted? Nobody is going to vote differently or change their behaviour because a boson has been found.

Perhaps one function of much science journalism is aesthetic. All those stories about particle physics and astronomy evoke the sublime. The function is not to inform the citizenry – who, after all, is really well informed about the Higgs even after all the news reports? – but rather to provide an opportunity to express awe and wonder. In that case, not explaining becomes a virtue. The sublime operates through a sense of the magnificent and powerful that is almost within our grasp, yet resists our attempts to contain, and thus explain, it.

This leaves science journalists in a curious position. Their daily beat concerns the generation of an emotional response to a field that is avowedly unemotional; their job of explaining depends on the inadequacy of explanation; and the journalist's traditional role of holding those in power to account is suspended in place of celebrating scientists' accomplishments. Arguably, this routine rendering of the sublime leaves the science journalist ill-prepared when faced, not with wonder, but with the messy science that is entangled in issues of social and political importance – the science about which readers do need to make up their minds. ■

Felicity Mellor is course leader and a senior lecturer on Imperial College's MSc in Science Communication.

"I WAS TAUGHT THAT SCIENCE IS NOT SEPARATE FROM CULTURE, IT IS CULTURE"

***Gareth Mitchell** discusses how the relationships between science, society, geek culture and the intimate medium of radio have changed over the last two decades.*

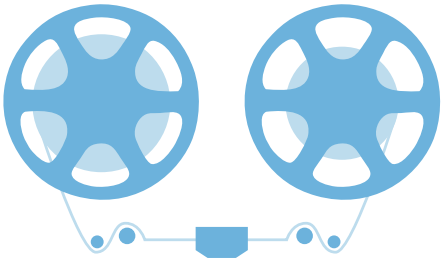
I still have a copy of my MSc in Science Communication radio coursework. It is not a file on my computer, but a spool of magnetic tape. We students in 1994 recorded location interviews on a SONY Walkman and edited tape with a razorblade and sticky tape. Feedback with our tutor was in class once a week. Today, my students record straight onto a flashcard and edit on powerful audio software. Supervision and feedback are as easy as exchanging files through email and Dropbox.

How things have changed. But more surprising is what has not changed. In my day, we were rewarded for vivid storytelling and penalised for sloppy editing. As our tutor did in the class of 93/94, I too give extra marks for good writing and dock marks for poor sound quality. The components of short radio features have remained the same: interviews, narration, and maybe some sound effects or music.

Two decades ago, BBC Radio 4 had a weekly topical magazine programme called *Science Now*. In 2012, Radio 4 has a weekly topical magazine programme called *Material World*.

Though of course, there are differences between the two eras. A radio programme like *Infinite Monkey Cage* would never have been commissioned when the MSc in Science Communication began in 1991. Back then, few would have imagined Radio 4 broadcasting an audience-based hybrid of science, comedy and satire co-hosted by a comedian and a rock star celebrity physicist.

But *Monkey Cage* is not about how radio has changed. It reflects more about how science, scientists and science communication have shifted. Like today's MSc students, I was taught that science is not separate from culture, it is culture. Intellectually it seemed like a plausible position, but I am not sure that I fully believed it at the time.



But even outside our bubble, who would argue against that notion today? There are festivals devoted to science, it's as often the subject of feature articles or panel discussions as history or art, comedians do routines about it and celebrities tweet about it.

A separate but related phenomenon of these last decades has been the rise of geek culture. The 'G' word was not generally used kindly in 1991 but today, geeks establish multibillion-dollar social media empires, they discover the Higgs boson and create probes that tweet high-resolution pictures back from Mars. When it comes to fashion, the coders I meet at tech conferences seem indistinguishable from the trendies that hang out in Hoxton.

In the 1990s, very few scientists presented television or radio shows about science. Now, it is a prerequisite. It brings us back to *Infinite Monkey Cage* and its nerdy, funny presenters accompanied by a willing panel of scientific guests. The show sells out at festivals and has a thriving Twitter following.

I'm surprised at the similarities in format between today's science radio and that of the nineties. *Monkey Cage* seems like an exception, but really it is just a reminder that what has changed is nothing to do with digital editing or cheap solid-state audio recorders. Instead, it tells a wider story about how society's attitude to science is so very different to that of 1991. ■

Gareth Mitchell is a lecturer in Broadcast Communication (Radio) in the Science Communication Group at Imperial College London.

AN INTERVIEW WITH...

*Journalist and lecturer **Wendy Barnaby** speaks to **Juan Casasbuenas** about the changing world of journalism, and how she prepares students for it through her lecturing.*

HOW DID YOU BECOME A SCIENCE JOURNALIST, AND LATER A LECTURER?

To be totally honest I just fell into journalism. This was in the 70s – I was living in Stockholm looking for something to do and an opportunity arose for me to write, but I didn't have any training. I started to work in journalism in an irregular way, and I became really interested in it. Fast forward to around 2005 or 2006, and Imperial College asked me whether I want to teach on the print module. I thought it was an incredibly interesting thing to do, so took the job. I've been freelance all my journalistic life, so it wasn't as if I had to leave a job to take this one. When you are freelance you can just pick up jobs on the way so it was an easy decision.

OUTSIDE OF JOURNALISM, ARE YOU INTERESTED IN SCIENCE COMMUNICATION IN GENERAL?

My interest in science communication did not just arise from the print module, which is actually all about teaching people to write. It isn't strictly science communication except that it is, of course, in that you are teaching people to write, to communicate. I edit a magazine called *People and Science* that is published by the British Science Association, and that takes me more towards the academic side of science communication; it is very much about public engagement. We look at the different approaches people are taking, the things they are doing and the sort of evaluations they are trying to carry out.

AS THE FIELD OF SCIENCE COMMUNICATION EVOLVES, ARE YOU FINDING THAT THE PRINT MODULE HAS HAD TO CHANGE IN RESPONSE?

Writing is writing. Okay, you have to write differently for the web or for the page, but the basics of writing to interest people in a subject that they don't know much about are exactly the same: asking people about things, and translating it into something that will interest people. That is basically what we do. It is simply taking place in a different environment now, because of electronic media which has had such a huge impact on journalism as a whole. This has had a huge impact for newspapers, their economic situation becoming quite dire and people wondering whether they will survive.

HAS THE EXPERIENCE OF BEING A JOURNALIST CHANGED A LOT IN YOUR EXPERIENCE?

When I began as a journalist there were no computers – thinking back, I wonder how we managed to do anything! But of

course it was so much more relaxed; you'd ring people, see them, talk to them face to face. It was great fun and enormously valuable. As a journalist you got a much deeper understanding of what your subjects were doing, more than you tend to these days because the whole thing is quicker and more superficial. The essence of journalism is the same, but the way you do it and the context in which you do it has changed.

HOW DO YOU PREPARE STUDENTS FOR THE WORLD OF JOURNALISM?

I think we need to give them a good overview of what sorts of things people will need to be able to do when they go out into the workplace. It's not the topics we need to cover, it's more the culture that you have to try and impart: how busy it is, the pressure of it, the way you simply won't be forgiven if you don't meet a deadline. Journalism is very unforgiving in that sense and we have to forget sometimes that we are sitting in a university seminar room and put ourselves in the mind-set of the industry.

COULD YOU GIVE ME A SPECIFIC EXAMPLE?

We give them a press conference every year, and bring in a real life researcher for them to interview. This is after they have had some experience with a spoof press conference, and have practiced interviewing, giving them a taster. Then we bring in a proper researcher and expose them to a real press conference. The students then write for four different outlets – this could be for *The Times*, or the *Daily Mail*. We make it so that it is absolutely like what happens in real journalistic life.

WHAT ARE THE KEY LESSONS THAT STUDENTS TAKE AWAY FROM THESE EXPERIENCES?

You learn how to ask questions, learn what area of a body of knowledge that is being presented to you will be interesting for the audience you are writing for. And that is something that is quite hard to learn as a journalist, especially if you come from an academic background. It is easy to treat a body of knowledge as interesting for its own sake. Whereas when you are a journalist you are almost always writing for the people who are going to read it, and you have to put yourself in their shoes all the time. That is something we definitely try and make really realistic on the course. ■

Wendy Barnaby is a freelance journalist and former chair of the Association of British Science Writers. She has written for numerous publications including Nature and New Scientist; she also teaches print journalism on the MSc in Science Communication at Imperial College London.

ICONIC SCIENCE

Siobhan Chan takes a look back at six of the most iconic topics in science from the last two decades.

CHEMISTRY: NANOTECHNOLOGY

If good things come in small packages, then it's no wonder nanotechnology is garnering so much excitement. Already on the market in the form of silver-infused plasters and anti-odour socks, potential applications include drug delivery, touchscreens and even elevators to the moon. The power of graphene and carbon nanotubes lies in their thickness of a single atom. Earlier this year, IBM managed to shrink down a hard-drive to only 12 atoms in size, enough to store one data 'bit'. However, there are also the requisite science fiction fears involving microscopic robots self-replicating and consuming everything on Earth.

BIOLOGY: DOLLY

1996 saw the birth of Dolly, the first mammal to be cloned from an adult cell, and the world's most famous sheep. By transferring the nucleus of an udder cell into an unfertilised egg cell, Ian Wilmut and his team from the Roslin Institute were able to show how a differentiated adult cell could be persuaded to revert back to an all-purpose, 'omnipotent' cell. Since Dolly, many other large mammals have been cloned, but according to Wilmut, the technique may never be viable in humans, much to the relief of anti-cloning groups. It has, however, been used to bring a Pyrenean ibex, a form of wild mountain goat, back from extinction for seven minutes.

Image: Toni Barros

PHYSICS: HIGGS BOSON

The world watched as Peter Higgs wept and Stephen Hawking smiled. Higgs described the discovery of his particulate namesake in July as the "final piece of the puzzle" in our understanding of the universe, supporting the Higgs field theory which explains how matter has mass. 10 years and billions of pounds in the making, the Large Hadron Collider is an example of Big Science in all meanings of the phrase, showing just what international collaboration can achieve.

ENVIRONMENT: OZONE LAYER

In 1984, British Antarctic Survey scientists discovered that the ozone layer above the Antarctic was beginning to thin. Two years later, and the hole was the size of the continental US. Scientists were quick to link this to CFCs and within 10 years, we had phased out the chemical in the UK and Europe which had been extensively used in aerosols, refrigerants and packaging. Scientists' work had a measurable impact on industry and policy, and alternatives to this widely used chemical were found, making this one of the big science communication success stories. The ozone hole is expected to disappear by 2050.

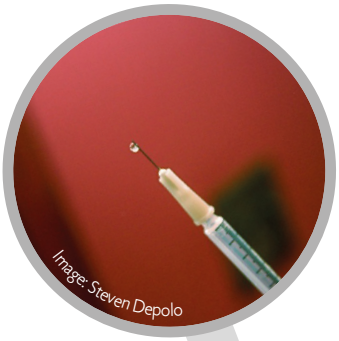


Image: Steven Depolo

MEDICINE: VACCINES

The first human papilloma virus (HPV) vaccine was approved for use in 2006 and since 2008, the UK has rolled out nationwide vaccination of 12 and 13 year old girls. HPV is responsible for cervical cancer, genital warts and anal cancer, and there have been calls for boys to be vaccinated. This is in sharp contrast to the MMR vaccine scare of only a decade before, which saw public trust in clinicians fail and led to incidences of measles skyrocketing in the UK. While the search for an effective HIV vaccine is ongoing, the FDA approved a pill to prevent HIV infection.

TECHNOLOGY: WORLD WIDE WEB

"This is for everyone." Tim Berners-Lee's appearance at the London 2012 Opening Ceremony reminded us all how much we owe to the generosity of one man. The web, designed while Berners-Lee and colleagues were at CERN, was arguably invented to ease the sharing of scientific information. The public have had access to the web since the mid-1990s, and science communication has thrived, with blogs and the rise of open access journals. 'Citizen science' projects like Foldit and Galaxy Zoo have redefined the idea of public engagement, giving non-scientists the chance to make sense of data to help understand proteins and distant galaxies.

Image: Rock1997

Meet the Alumni

*From electrocuting Gavin Henson to public engagement in Kenya, **Joel Winston** discovers that there is no such thing as a typical Science Communication graduate.*

JULIETTE MUTHEU

Science Communication, 2010/11

SCIENCE COMMUNICATION SPECIALIST IN KENYA

While training in biomedical research in Melbourne, Australia, Juliette Mutheu began her venture into science communication as executive producer for a student radio show on topical health issues.

After her studies, she moved back to Kenya to conduct research into the epidemiology of malaria in children, and became involved in setting up Kenyan Science Cafés to engage the public in scientific research.

"I had only recently moved from a scientific research career to science communication," says Juliette. "I had the passion and enthusiasm for communicating science but no actual training." So Juliette came to London to study Science Communication, and developed the skills that she was looking for.

But her travels weren't finished there. Juliette secured an internship at the Okinawa Institute of Science and Technology in Japan, where she got involved in science writing, podcasting, photography and social media.

Now working at the KEMRI-Wellcome Trust Research Programme in Kilifi and Nairobi, Kenya, Juliette assists researchers in engaging key stakeholders through media briefings, social media, the web, and public events. She is currently working with colleagues to develop a structured platform to enable effective and timely science communication.

"The beauty of science communication is that there's a range of things a person can do to engage the public in science and one person can't do it all. But if you have a network of different people with different skills and you bring them all together, imagine the impact you can have."

MORGAINE MATTHEWS

Science Media Production, 2008/9

CREATIVE COPYWRITER

If anyone can prove that Science Media Production graduates don't always take the predictable route into broadcast, then it's Morgaine Matthews, who instead opted for a career in advertising.

When she started her Masters in 2008, Morgaine wanted to learn more about science communication and the media, while also developing her creative skills. But by the end of the course, her aims were quite different to most of her course mates. "After graduation I was far less concerned with the science communication side of things and completely focused on finding a creative career," says Morgaine.

Since graduating, Morgaine has worked at an advertising agency as a creative copywriter and junior art director, choosing the career because of the challenges involved.

"You work within a creative team which is great fun, but the best part is the variety. One day you could be developing a computer game, then the next day you're writing a script."

But Morgaine has no regrets about the route she took into her career, and says that although she could have ended up there without the course, it would have taken longer. "Having the Master's meant I could jump straight into a creative environment and feel comfortable from day one."

GREG FOOT

Science Media Production, 2005/2006

BBC SCIENCE PRESENTER & SCIENCE JUNKIE

Having already tried his hand at student radio and making science videos during university, Greg Foot was determined to escape the lab and explore the world of science communication.

"I'd been making showreels and sending them to producers, keen to move into science presenting," says Greg. "I also loved filming and editing. So my plan was to go brush up on all those skills and see where they could take me."

After honing his production skills at Imperial and sending out even more showreels to everybody and anybody, Greg worked his way up the TV production ladder, moving from Runner to Researcher to Assistant Producer to Producer, working on a range of science shows.

"I also built up my presenting experience – from a CBBC science series on BBC One, to electrocuting Gavin Henson for Bravo, to my most recent series on BBC Three 'The Secrets of Everything', where I was buried alive, frozen, shot and burnt in the name of science."

Greg has also set up 'Science Junkie', a company that takes science shows into schools and science festivals.

As a freelancer, Greg is familiar with the feeling of not knowing where the next job will come from, and the need to network and chase opportunities. "It's been hard, and has felt like a massive game of Snakes and Ladders, but it's been worth it."

He has also noticed that more employers are now looking for people with a range of skills. "So don't just be a good researcher. Learn to film, edit and scriptwrite too. Plus, knowledge of social media and using it to your marketing advantage is a cracking skill to have."

GRAHAM EASTON

After four years as a junior doctor to become a GP in 1994, Graham Easton was happy to take a breather from medicine and focus on writing and communication. But he certainly didn't expect things to turn out the way they did.

Straight after a work placement at the BBC, Graham was lucky enough to land a senior producer role in the World Service Science Unit. "I felt hugely under-qualified and unsure about turning my back on medicine," says Graham. "But it was too good a chance to pass up."

Over the next nine years, Graham worked as a health reporter, producer, duty science news editor, and for five years presented 'Case Notes', a medical magazine programme on Radio 4.

But being a restless soul, Graham was ready for a change. To get experience in print journalism, he spent four years as assistant editor at the British Medical Journal before moving back to a mix of clinical medicine and teaching. "This meant some re-training and sitting professional medical exams aged 40 with a young family, which was tough!"

Alongside fitting in three GP surgeries a week, Graham is now Deputy Director of Primary Care Education at Imperial, teaching communication skills to medical students, and running courses for doctors in China. He is also on the editorial boards of two medical journals, presents podcasts for doctors, and is currently studying for a doctorate in education, focusing on the use of narrative in teaching medicine.

"Although it sometimes feels as though I have lurched from one job to the next without much planning, with hindsight I can see a definite career pattern. Everything I have done in the past is at the heart of what I am doing now, and it feels right."

Science Communication, 1994/95

DEPUTY DIRECTOR OF PRIMARY CARE EDUCATION, IMPERIAL COLLEGE

EHSAN MASOOD

EVERYTHING (AND NOTHING) HAS CHANGED

In 1992, a Conservative government was in office. Public spending was being capped. Politicians were beginning to feel the heat of public anger over "genetic engineering" and the shadow of a fatal nuclear accident had cast doubts about the future of the nuclear industry.

Two decades later, it appears that not much has changed in terms of priorities for science in policy. This may be because the three main political parties are now closer than ever; successive governments have sought to stand on the shoulders of their predecessors' science policies, rather than dismantle what came before and start afresh.

Ehsan Masood is the editor of Research Fortnight and Research Europe, and teaches international science policy on Imperial College's Science Communication MSc.

1992 | 2012

WE DON'T EAT GENES

NGOs such as Greenpeace and Friends of the Earth were beginning to organise what became one of the most successful global campaigns in their history: to prevent the commercialization of genetically modified (GM) technology in food. In the UK, their cause was helped by Labour's long-serving environment minister Michael Meacher, who effectively served as their champion in government and fought hard to block the influence of big business (via the Department of Trade).

Today, Europe is a desert when it comes to commercial gene technology in food for human consumption. Authorisation for field-tests of GM products is difficult too. Partly as a result, plant science in UK universities has become weaker, which the government has only now recognized. The Bill and Melinda Gates Foundation is beginning to provide funding. At the same time government and business have learned lessons and are treading more cautiously with plans to commercialise synthetic biology.

BYE BYE NUCLEAR?

In 1992 the world was still reeling from the Chernobyl nuclear accident in 1986 and the UK all but abandoned plans to renew its fleet of ageing Magnox nuclear power plants. Instead, government and business were preparing to build an underground laboratory close to Sellafield near the Lake District to study whether the area was suitable for deep disposal of existing nuclear waste.

In 1997, Conservative environment minister John Gummer killed off any plans to bury nuclear waste near the Lake District, weeks before a general election would sweep the Tories from office. Renewable energy for a while dominated energy policy, but any hopes that nuclear would be an increasing part of the energy mix were dashed with the Fukushima tragedy in Japan in 2011.

	1992	2012
SCIENCE MUST PAY ITS WAY	Keith Joseph, mentor to Margaret Thatcher and Conservative secretary of state for education, felt that scientists needed to be more accountable for receiving public funds. Out of this came the Research Assessment Exercise (RAE), a system of distributing research funds based on a grading of quality. Paradoxically, even such an ideologically-Conservative government had no plans of charging students to go to university.	The RAE continues to thrive (in future it will be called the Research Excellence Framework). It has helped UK scientists to be among the most published (and most cited) in the world, but has probably introduced more short-termism and other unintended effects. The RAE is good for narrow specialists and bad for polymaths and big-picture thinkers. It has been much studied by other countries (notably the USA and Australia), but never copied.
INNOVATION AND THE RISE OF PATENTING CULTURE	Two landmark pieces of legislation from America (both from 1980) were being applied in the UK and soon across Europe. The Bayh-Dole Act allowed universities to patent products and processes created from government funding and Diamond v Chakrabarty was a US Supreme Court ruling that allowed the patenting of genetically modified organisms. This was part of a wider agenda and in the UK it included the government selling off many publicly-owned research labs such as the National Physical Laboratory and the Laboratory of the Government Chemist.	Making money from knowledge (now known in policy circles as "innovation") is now all the rage and there is barely a university without an associated commercialisation arm. However, 20 years of constantly pushing universities to think commercially has now created something of a reaction among academics. Helped by the success of the Open Source and Open Access movements, some universities are beginning to dabble with what is being called Open Innovation. Watch out as a wounded Big Pharma comes knocking on the doors of universities as it seeks to find cheaper ways of making blockbuster drugs.
WHO NEEDS EVIDENCE?	Back in 1992, the UK government had a mere handful of scientific advisers. But they were often men and women of immense influence, such as Crispin Tickell who persuaded Margaret Thatcher of the risks from environmental threats, or John Ashton, who persuaded the Foreign Office that it needed to expand its scientific diplomacy.	Today, most UK government departments have a chief scientific adviser and there is increasing interest from all parties of finding ways to test the evidence behind proposed policies. At the same time there are few research-trained/research-aware MPs and if the House of Lords becomes mostly elected, we are likely to lose many scientists who have said they will not stand for election.

ENGAGEMENT WITH OBJECTS

***Rachel Souhami** charts the brief history of museum interactives – from quick political fix to a promise of engagement*

It's strange to think that if you'd walked into a science museum thirty years ago, you would have been hard pushed to find any interactive exhibits. Such exhibits didn't become a staple of science exhibitions until the mid-1980s, and though it would be tempting to say that this was connected to trends in science communication, it's got just as much, if not more, to do with offering a solution to political contexts. However, the key issues for museums have changed, and interactives may no longer offer the quick fix for science museums that they once did.

When the Royal Society published Walter Bodmer's report *Public Understanding of Science* in 1985, it was against a background of changes to the funding and management of public museums introduced by the Conservative government. These meant that museums had to justify their income from the state, compete for visitors, and find private sources of funding.

Bodmer's report enabled science museums to make a case for funding. In addition, science museums imported the concept of interactivity from the US to make their exhibitions fun and educational, which was as much about creating a USP to attract visitors as it was about a new means of communicating science. It was a successful solution in that the exhibits were popular, and so interactives became commonplace.

The 'deficit model' advocated by Bodmer, where scientists 'educate' the public, has long been discredited, but interactives have hung around for two quite different reasons. One of these concerns town planning: twin agendas of informal science education and urban regeneration, combined with government funding, led to a number of councils developing science centres as flagship projects for regeneration schemes. The other reason was the advent of engagement as a concept both in science communication and as part of broader cultural politics – this time with policies introduced by New Labour, which again had an impact on funding.

Engagement is problematic when applied to exhibitions: what does it mean? One might argue that simply coming to an exhibition was a form of engagement. And how does one have dialogue with inanimate objects? Here interactives came to the rescue again, providing a means for visitors to record their thoughts on a subject, usually at a computer terminal. What happened to those comments, and whether such interactions can be considered meaningful dialogue, is another question.

Engagement and dialogue are still hot topics for museums, but not in relation to science communication. Instead the broader museological question of interpretation of collections has become increasingly prominent: who is able to give the meaning and history of an object? Whose voice should be heard in an exhibition?

These questions relate to the long-term documentation of collections, engaging communities in interpreting objects, and the editorial policies of museums. These are issues that require far more complex solutions than an interactive exhibit, ones that go to the root of how museums operate and how exhibitions are made. That is not to say that interactives are on their way out, but perhaps their days as a panacea are over. ■

Rachel Souhami is a lecturer in Science Communication (Museums) in the Science Communication Group at Imperial College.

OBJECTS – BUT NOT OBJECTIVE?

What is it we see when we go to a museum? The objects themselves, or the stories and information that museums choose to tell us about them? Take a polystyrene cup. The interpretation of this object could include its functional use, history, manufacture, symbolic meaning or value to society – but rarely all at once.

Its interpretation is subjective, shaped by factors including practical constraints like the word count of its label, the topic of its exhibition, and the museum's identity and intellectual remit. Cultural and social aspects come into play too.

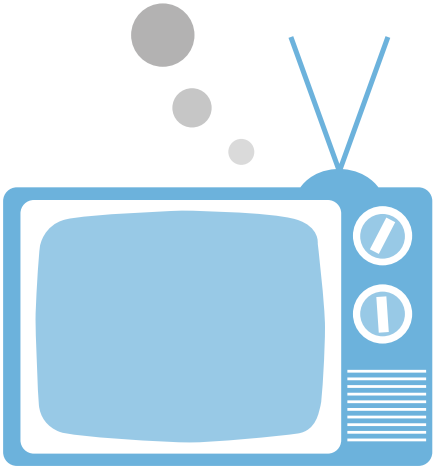
Objects in museums tell us of how the world might be. The role of our plastic cup might be to act as a symbol of our reliance on petrochemicals, our drinking habits, or contemporary design solutions – any number of things. But one thing's for sure, it won't be all of them. While museums might always aim to tell the truth, it's never the whole truth. ■

VANNA BARBER

FOR A VISUAL ANTHROPOLOGY OF SCIENCE

BOB STERNBERG

> “WHEN SHOOTING WESTERNS... USE REAL INDIANS IF POSSIBLE; BUT IF INDIANS ARE NOT AVAILABLE, USE HUNGARIANS.”
>
> *– from a classic American text on lighting*



In a sense, all films are ethnographic films, either in form, content, or both, because they reveal cultural patterning. Film as a cultural product is not unique in this regard, but the mechanical nature of photography has given it special status. For anthropologists, the documentary camera appears to offer the possibility of fixing something of the details of lived experience free from the subjectivity of field notes. It was this possibility that prompted Grierson to coin the term documentary, writing of Flaherty's Moana that it had 'documentary value'. The camera could capture, automatically, something of the essence of a culture and its people.

The movie camera was invented to capture motion. It was put to use as early as 1874 by the French astronomer Pierre-Jules-César Janssen, who that year recorded the transit of Venus from his hut in Yokohama. In the 1880s, Eadweard Muybridge and Étienne-Jules Marey advanced the technology with devices they invented for studying animal locomotion. Of necessity, they built these machines themselves, but in 1895, for the first time, the Lumière brothers made an all-purpose camera available to anyone who could afford it.

Initially it was trained on people doing ordinary things—rowing a boat, having breakfast, playing cards or descending from a steam train—but soon it was made to record the fantastical journeys of Méliès and the no less hazardous trips of European explorers. Thus the ethnographic film began almost immediately as a phenomenon of colonialism. In the far-off lands of Empire, Europeans encountered peoples whose cultures, even then, were threatened with extinction and with their cameras they attempted to rescue what was disappearing. But today, although we have long since turned the cameras back on ourselves, the world of science, where film was born, remains largely unexplored by the visual anthropologist.

There is a price to that isolation. As with any unknown tribe, rumours circulate about customs and practices. In the 1940s the sociologist Robert Merton spread a number of such stories about the selflessness of scientists and the openness of their institutions. Although this picture of science has been challenged over the last forty years, so noble was Merton's characterisation that it continues to be embraced with little demur today, reinforced by numerous television documentaries.

The trouble with films is that they have a tendency to lie, and the audience a tendency to believe. The science documentary, made in retrospect and constrained by the need to explain, necessarily prevaricates about how science is done. For the sake of a clear narrative it usually ignores the uncertainty of experimental results and fails to mention the blind alleys of research. Only rarely, if ever, does a programme document the non-Mertonian culture of secrecy that is common in science, or give any hint of the inter-personal competition that blights the lives of so many researchers. Because such films appear plausible, they diminish the importance of what they leave out and we quite naturally take the science documentary that explains for an image of science as it is practised. In this way we misconstrue the nature of science and of scientists—we mistake Hungarians for Indians. ■

Bob Sternberg is the Leader of the MSc Science Media Production course, and a lecturer in Broadcast Communication (TV).

Alice Bell discusses a more mindful phase for science communication, in which we mustn't be afraid to disagree

BETWEEN CONTROL AND CREATIVITY

A friend once told me about a meeting he attended in the mid-1990s where, apparently, a group planned to take over UK science communication. Imagine the power! To control which scientific ideas, voices, and bits of information are placed into the public realm. Control what is seen as a rational decision about health, energy, agriculture, and more. Control the collective ideas of the future. Imagine the influence! Imagine the money!

This story is hearsay and not from the most reliable source, so I won't reveal who was meant to be at the heart of such a dastardly plot. I share it because it almost doesn't matter who it was, or if it is true at all. The basic warning still stands: control public debates about science and technology, and you get to control many threads of how we spin our idea of progress.

For that reason, I think it befits everyone working in science communication – be this journalism, PR, engagement, education, or showbiz – to recognise the politics of their work and keep an eye out for ideologies, interests and limitations they don't personally subscribe to. We don't need to agree on which politics is correct, just acknowledge that it's there.

I got into science communication because, as an ever-so-earnest teenager, I thought it could save the world. A few years in the kids' galleries at the Science Museum and an STS degree or three shocked some cynicism into me, but the basic hope is still there. If anything, such cynicism has simply made me more aware of how easy it can be for science communicators to oil the wheels of some not especially nice or clever directions for the planet.

We need to check that our creativity is not exploited. We need to ask economic, political, and cultural questions as well as scientific ones. We need to ask these questions of ourselves, our friends, and our funders as well as others. We need to be willing to feel a bit uncomfortable. We need to be able to disagree.

> **WE NEED TO BE WILLING TO FEEL A BIT UNCOMFORTABLE**

What we do has the power to change the world. It really does – only ever in small incremental ways, and never, ever enough. Compromises will always be necessary too. But each action adds up. If science communication really has come of age with the 21st birthday of Imperial College's MSc, it needs to recognise its power as well as its limitations and stand up for itself. ■

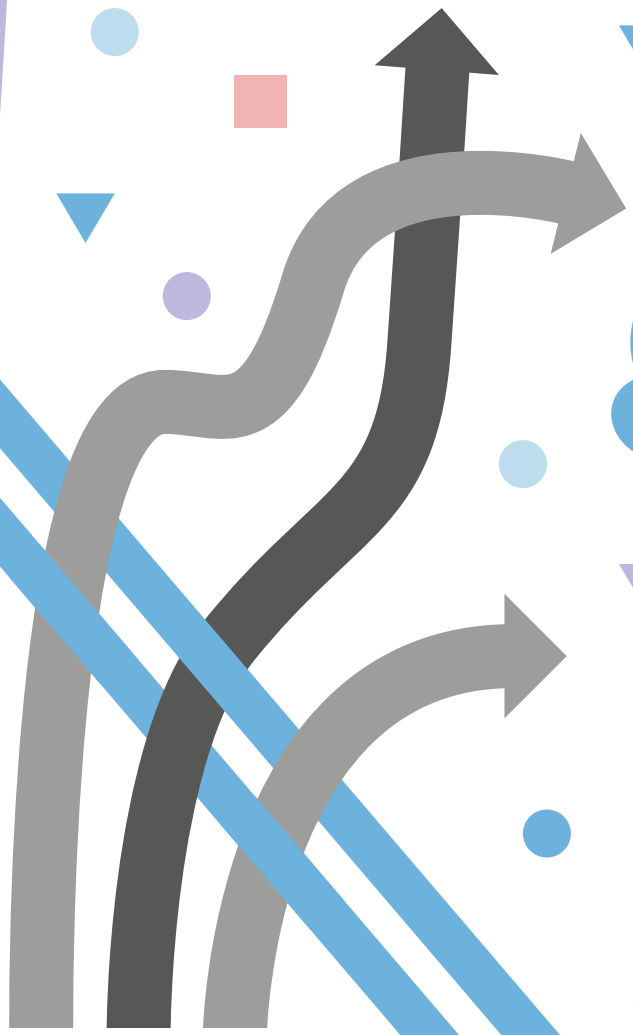
Alice Bell is Senior Teaching Fellow at Imperial, directing the new Global Challenges course. She completed a PhD in the Science Communication Group in 2008.

"PERHAPS ONE FUNCTION OF MUCH SCIENCE JOURNALISM IS AESTHETIC"

– *Felicity Mellor*

"I GOT INTO SCIENCE COMMUNICATION BECAUSE I THOUGHT IT COULD SAVE THE WORLD"

– *Alice Bell*



"ONCE LEVERED OPEN BY THE ENQUIRING MIND, SCIENCE FIZZES WITH PHILOSOPHICAL AND CULTURAL CONCERNS"

– *Stephen Webster*

"I WAS BURIED ALIVE, FROZEN, SHOT AND BURNT IN THE NAME OF SCIENCE"

– *Greg Foot*

HIGHLIGHTS FROM THIS ISSUE

THE
SCIENCE
COMMUNICATION
ISSUE