Postgraduate Research Magazine

FRONTIER

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BODY INVASION
Parasites that control their host

The Forgotten Organ
An insight into the distribution of funding for respiratory research

Meet the Vice Chancellor
An interview with Professor Paul Boyle

Research Methods
Polyclonal vs Monoclonal Antibodies
Editorial

I am delighted to have been asked to write the editorial that launches the second issue of Frontier. Frontier is entirely led by postgraduate research students at the University of Leicester who have written and edited the articles, designed the graphics and put this issue together. The articles in Frontier cover the range of research activities that our postgraduate students are involved in across the different Colleges at the University and demonstrate the contribution that the students make to our research community. I am delighted with the high quality magazine that they have delivered. Postgraduate research students develop many skills during their PhD that may be directly relevant to their future careers or may not be used as much. The one skill that any student will use whatever their future career is the ability to communicate to non-specialist audiences their excitement and enthusiasm for what they are doing and why it matters. This issue gives postgraduate students an opportunity to see the great research being conducted at the University of Leicester and I hope that other postgraduates are enthused and motivated by what they see to contribute an article in the future. It doesn’t matter whether you are a student based on campus or studying at a distance, please get in touch with the team on their email frontier@le.ac.uk. I would also like to thank the key people that have driven this initiative forward, in particular Sarah Bugby whose enthusiasm for Frontier has been key to ensuring it continues to be a voice for postgraduate research students. I am also grateful to all of the editorial team and Jason Wickham as Graduate School Officer who has helped with the development of this issue. I hope you enjoy reading the magazine and we would be pleased to receive your feedback or articles for the next issue.

Professor Sarah Hainsworth
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We have received incredible support and advice from Dr Sarah Bugby and Dr Jason Wickham, who were always available to help and guide us. We would also like to extend our thanks to staff across the University for supporting Frontier and helping us to spread the word, to the current Vice-Chancellor Professor Paul Boyle for his enlightening interview, and to all the postgraduate students who have contacted us with feedback, articles and offers to get involved.
Editorial Team

Felicity Easton
Felicity is part of the Infection, Inflammation and Immunity department investigating Calcium-carrying ion channels and their role in the innate immune response of human airways, for diseases such as asthma. With a background in pharmacology, neuroscience and software development, Felicity has a keen interest in programming and database architecture, and plans to combine this with microbiological research. Outside of the lab, she can be found playing the violin or baking something deliciously unhealthy.

Jonathan Smith
Jonathan is a PhD student researching neurobiology and behaviour in desert locusts. His project explores how solitary grasshoppers group into swarms of locusts. When he is not chasing escaped insects around the laboratory, he is writing, playing music, reading science fiction/fantasy books or playing around with his computer.

Francisco Valente Gonçalves
A forensic psychologist trying to understand how forensic experts make their decisions? Yes, this is the life of Francisco Valente Gonçalves, a Marie Curie Early Stage Researcher within the INTREPID Forensics Programme based at the Department of Criminology. Francisco tries to observe the variables that affect forensic experts’ motivation and decision-making processes. Working with a wide range of forensic bureaus on aspects such as cognitive bias, he believes bias can have a positive feature besides the negative aspect that research already showed. Besides messing with forensics, you can find him cooking, his way to relax. Probably with a good glass of red wine!

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Have you ever gazed up at the countless twinkling points of light in the night sky and wondered if we’re alone in the Universe? With over 300 billion stars in the Milky Way, it does not seem so far-fetched to imagine that some of these stars are orbited by planets that possess conditions that enable life to flourish, just as the Earth does. Thanks to simulation work carried out at the University of California, Berkeley, we now estimate that there could be up to 40 billion Earth-sized planets in our galaxy alone and it seems extremely probable that at least some of these could support life.

This is an exciting prospect, but how can we actually detect whether such life exists and where should we start looking? The tantalising possibility that life exists elsewhere in our Solar System, in our very own cosmic back yard, has captured imaginations for centuries, but detecting this life has remained just out of our grasp. However, researchers have now discovered that the method that could give us our best chance of finding life on another planet has been around for some time, but in a field quite different to planetary exploration: the world of art and heritage.

In 2006, Professor Howell Edwards, previously of the University of Bradford and currently a visiting researcher here at the University of Leicester, was invited to investigate the de Brécy Tondo, a Madonna and Child tondo painting, alongside Timothy Benoy of the de Brécy Trust. It is believed that the tondo was painted in the 16th century during the Italian High Renaissance and it has been attributed to the great master painter Raphael (who was a contemporary of Leonardo da Vinci and Michelangelo), largely due to stylistic similarities with his Sistine Madonna. As part of his investigation, Edwards analysed small flakes of the tondo’s paint, approximately 1mm² in size, using Raman spectroscopy to try to shed more light on its origin.

Liam Harris explains how Raman spectroscopy, a technique much more commonly associated with art and heritage studies here on Earth, might help to detect signs of past or present life on the Red Planet.

“We now estimate that there could be up to 40 billion Earth-sized planets in our galaxy alone”
once thought to be completely inhospitable, including the Atacama Desert and the bottom of the Marianas Trench in the Pacific Ocean. Bacteria have also been found to survive in the Antarctic, where they must withstand extremely cold temperatures and high ultraviolet light (UV) exposure, conditions not entirely unlike those found on Mars. Interestingly, bacteria defy harsh conditions such as high UV exposure by producing coloured pigments, much like those used by painters, which act like sunscreen to protect them from damage. Fascinatingly, these pigments can be detected and identified using Raman spectroscopy in precisely the same way as those used on historical paintings such as the de Brécy Tondo.

Was it Raphael? – The de Brécy Tondo pictured here shows a striking similarity to the Sistine Madonna

Raman spectroscopy can be used to identify all manner of materials in an unknown sample (in this case, a few flakes of paint) by exposing the sample to light of a single wavelength or colour, usually from a laser. Some of the light is absorbed by the molecules within the sample, causing them to vibrate and resulting in a different colour of light being re-emitted. This change in colour is highly specific to each particular molecule, so acts like a fingerprint that can be used to determine the composition of the unknown sample.

Using this method to analyse three paint flakes from the tondo, Edwards found that the paint contained a starch-based binder (a component of paint that helps it to stick to the medium), a siccative (a compound that speeds the drying process of oils) and a number of pigments that were known to be used in Renaissance Italy. However, a synthetic pigment known as Prussian blue, which was created in 1706 (approximately 200 years after the estimated date of the painting of the tondo), was also identified. While this could have cast doubt over the provenance of the piece, Edwards stated that there could be a large number of explanations, both artistic and scientific, for the presence of this pigment on the tondo. Eventually the presence of Prussian blue in the de Brécy Tondo was attributed to an unrecorded restoration. Although the creator of the de Brécy Tondo has yet to be confirmed, Edwards’ research has highlighted the need for both artistic and scientific expertise in the forensic analysis of art.

Raman spectroscopy has not only become a technique relied upon by art historians and conservators, but could also be used to tell us whether one of our closest planetary neighbours, Mars, is or has ever been home to life. Mars is not a particularly hospitable world so you’d be forgiven for assuming that life could simply not survive there, what with its almost non-existent atmosphere, oxidising soil, lack of liquid water and the harsh solar and cosmic radiation that constantly bombard the surface of the planet. But in recent years, microbial life has been discovered in places on Earth which were once thought to be completely inhospitable, including the Atacama Desert and the bottom of the Marianas Trench in the Pacific Ocean. Bacteria have also been found to survive in the Antarctic, where they must withstand extremely cold temperatures and high ultraviolet light (UV) exposure, conditions not entirely unlike those found on Mars. Interestingly, bacteria defy harsh conditions such as high UV exposure by producing coloured pigments, much like those used by painters, which act like sunscreen to protect them from damage. Fascinatingly, these pigments can be detected and identified using Raman spectroscopy in precisely the same way as those used on historical paintings such as the de Brécy Tondo.

**“The ExoMars rover will carry the first Raman spectrometer into space”**

In 2020 the European Space Agency and Roscosmos, the Russian Space Agency, plan to launch the ExoMars rover, which, after 9 months of space travel, will touch down on the surface of Mars and begin to look for signs of life on the Red Planet. Amongst its many instruments the ExoMars rover will carry the first Raman spectrometer into space, which it will use to perform a forensic study of the Martian environment, much as Edwards did to analyse the composition of the de Brécy Tondo. The development of the camera for the ExoMars Raman spectrometer is currently being carried out by Dr Ian Hutchinson and his team here at the University of Leicester. If the rover and its spectrometer detect bacterial sunscreen pigments in the soil we will finally have evidence for the presence of bacteria on Mars. Furthermore, identifying these pigments will give the first indications as to how bacteria are capable of surviving seemingly impossible conditions on the surface of another planet.

**“If the rover and its spectrometer detect bacterial sunscreen pigments in the soil we will finally have evidence for the presence of bacteria on Mars”**

The analysis of works of art by Raman spectroscopy is a great example of a meeting between science and art and demonstrates that an appreciation of both disciplines is valuable. Likewise, the existence of extra-terrestrial life has preoccupied both scientists and artists ever since humans first looked to the night sky and wondered what’s out there. While we’re probably not going to meet any extra-terrestrial Raphael’s anytime soon, with the imminent launch of ExoMars and its Raman spectrometer, will we be meeting some microscopic artists sometime in the near future?

**References**


Liam Harris is a fourth year PhD student in the Department of Physics and Astronomy, doing research into the use of Raman spectroscopy as a tool for planetary exploration, mainly in preparation for the ExoMars rover mission, but also looking at exploring other places in the Solar System.
During the 2011-12 academic year, I took time out from my medical studies to conduct a research BSc under the Faculty of Medicine and Biological Sciences. The work entailed measuring the number of potentially harmful emboli - small solids or air bubbles in the bloodstream - which are a by-product of a procedure aimed at treating patients with a specific form of cardiac arrhythmia called Atrial Fibrillation (AF).

AF is an irregular rhythm of the heart that causes the flow of blood in the heart to become turbulent. It can result in blood clots being deposited in the brain, predisposing a patient to cerebrovascular (brain) injury. Emboli are any detached masses carried in the blood that are capable of clogging arteries, and those that reach the brain can result in damage commonly known as a stroke. AF can be treated with medication but in patients whose AF is resistant, an alternative treatment called catheter ablation is performed. This procedure involves passing wires through blood vessels in the patient’s groin, up to their heart to burn the areas of tissue suspected of causing the irregular rhythm in their heart (see CARTO3 map).

Previous studies have demonstrated that potentially significant numbers of emboli are produced during ablation, however the incidence of stroke in these situations is unclear. Using cardiac surgery as a well-studied comparison, with a low incidence of stroke, this research compared the number of emboli produced throughout both procedures.

To achieve this, patients from Leicester’s Glenfield Hospital undergoing catheter ablation for their AF were recruited to the research. Ultrasound probes were placed against patients’ heads while they underwent ablation and then analysed post-procedure for signals of emboli, this can be seen in the image below. These results were then compared to recordings from patients who had undergone heart surgery. The comparison of the two procedures showed rates of embolisation to be similar.

This research demonstrates an effective use of ultrasound to establish the frequency of emboli and could potentially lead to technologies that reduce patients’ exposure to these potentially harmful masses. However we acknowledge that the technique has limitations, currently it is unable to reliably discriminate between solid and gaseous emboli. The majority of emboli detected during catheter ablation procedures were assumed to be dissolvable air bubbles in the brain, much less sinister than solid emboli. As a result further studies into the significance of embolisation rates during catheter ablation for AF and the impact of emboli on patient cognition require investigation, with the aim of further improving patient safety.

Dr David Spiers has graduated from the University of Leicester and now works in the East Midlands.
Medical Diagnosis: The Next Generation

When somebody tells you that you look a bit ill, it’s usually just a friendly concern. Not so in the Diagnostic Development Unit at the Leicester Royal Infirmary, where researchers aim to turn this phrase into an actual medical diagnosis. Here your appearance may indicate what’s wrong with you. Through the application of state-of-the-art technology and established medical knowledge, article author Károly Keresztes explains how the DDU team may be able to remove the ‘fiction’ from ‘science fiction’ with producing in the longer term the iconic medical diagnosis tool: the Star Trek tricorder.

“The techniques build on the same principles used in medicine for hundreds of years, where physicians use their sense of sight, touch and smell to obtain a diagnosis”

Medical student and volunteer Tom Geliot is surrounded by technology aimed at measuring his vital body processes in real time.
Technological advancements are occurring at an impressive pace, but progress in the field of medical diagnostics has been far slower. In general, diagnosis still relies on invasive testing, often causing discomfort and leading to complications such as infection. Finding ways to circumvent these invasive procedures could thus save a lot of money, time and inconvenience to everybody involved. How can we use recent technological developments to aid in medical diagnosis?

Where no diagnosis has gone before

Over the past few years, Timothy Coats (Professor of Emergency Medicine, NHS and Department of Cardiovascular Sciences), Paul Monks (Professor of Atmospheric Chemistry, Department of Chemistry) and Professor Mark Sims (Professor of Astrobiology and Space Instrumentation, Space Research Centre, Department of Physics and Astronomy), have been developing non-invasive methods of medical diagnosis. This work has resulted in the creation of the Diagnostic Development Unit (DDU) at the Leicester Royal Infirmary.

The techniques build on the same principles used in medicine for hundreds of years, where physicians use their sense of sight, touch and smell to obtain a diagnosis. At the DDU we try to emulate these techniques with state-of-the-art equipment and sensitivity beyond human capability.

“Each patient will generate a vast amount of varied data that needs analysing and interpreting”

The development of instruments mimicking touch and smell is also underway. Body state and cardiovascular monitors replace the sense of touch. The monitors measure the heart and blood vessels’ response to your current health state. Smell is emulated with a mass spectrometer, spirometer, nitric oxide analyser and a carbon dioxide capnograph. These instruments determine the composition of exhaled air and provide an analysis of other bodily substances such as sweat and urine. The investigation of large datasets could help to identify and quantify a number of different disease markers.

An enterprising study

Currently we are working on our pilot study, where we are collecting data from over five hundred patients. These data will be used to determine the parameters for patients with common accident and emergency complaints in comparison to those of a normal population. There are three main challenges to contend with. The first is to populate our database with a large multivariate dataset including both imaging and spectral information. Given the size and complexity of the dataset, this is a key challenge in itself. The second challenge is the analysis of these data. Each patient will generate a vast amount of varied data that needs analysing and interpreting. Hence the DDU has assembled a team of experts from various fields to help with this interdisciplinary task. The final challenge after the data have been captured, organised and interpreted is the automation of the data analysis and interpretation process.

“Live long and prosper”

Once the above issues have been addressed, DDU will start to move towards a fully-integrated system that could resemble the technologies used in science fiction programs. Our current set-up looks very much like the famous medical bay in Star Trek. In the future we hope to miniaturise this technology into the well-known ‘tricorder’ or a range of such equipment for different medical needs. Imagine the day when a patient is need of immediate medical attention. The medical team arrives, give the appropriate diagnosis in situ and are ready to provide treatment within minutes. It sounds incredible, but this may no longer be something out of science fiction. The research in the DDU still has a long way to go, but the work we have done so far looks promising and, in combination with other diagnostic technologies, may enable this vision to occur given sufficient funding and time.

Károly Keresztes is finalising his PhD and is currently a Teaching Fellow at the University of Leicester

“A gas sampling instrument ‘smells’ how well the respiratory system’s running

“Looking peaky”

As a PhD student, I worked on the imaging aspect of the project. One component of this project is the thermal infrared imager. This imager builds a temperature map of the body, so it can be used to detect fever, infections and cardiovascular response to disease and treatment. We also utilised a visual wavelength Hyperspectral imager and spectrometry to analyse visible and near-infrared light. These tools may allow us to measure the properties of blood and physiology using skin pigments without using a needle! Hence, it could enable the rapid diagnosis of kidney and liver disease and possibly even cancer via subtle colour changes in reflected light.

“In the future we hope to miniaturise this technology into the well-known ‘tricorder’”
Parasites have evolved many ingenious ways of exploiting their host organisms - some can even control their host’s behaviour! PhD student Boris W. Berkhout explains how some parasites gain this control, and how his research will shed light on the evolutionary arms race between host and parasite.

When we get the flu or a similar disease, our body tries to fight off the attack through our immune system. This defence usually works well; we might feel ill for a couple of days and stay at home watching Netflix, but after that we soon start to feel better and can go back to work on our PhD projects. Unfortunately, not all diseases make it that easy for the infected individual. Some parasites, in particular, will try hard to make their host pretty sick, with certain species going so far as manipulating their host into being eaten by predators! Why would they do this?

**“Rats would normally run away from the smell of cats, but when they are infected with *T. gondii*, they become weirdly attracted to the odour”**

Climbing the food chain

Many parasites have complex life cycles, meaning that they require several different host species to complete their life cycle. A famous example is *Toxoplasma gondii*; this protozoan can use many warm-blooded animals, like rats, dogs and humans, as its first host. However, when it wants to sexually reproduce, it needs to infect a cat. So to move from rat to cat, the parasite alters the behaviour of its rat host. Rats would normally run away from the smell of cats, but when they are infected with *T. gondii*, they become weirdly attracted to the odour. Thus, upon encountering a cat, the poor infected rodent runs towards it kamikaze-style and usually gets eaten, passing *T. gondii* up to its feline host. In this way, the parasite can complete its life cycle.

**“The parasite cunningly infects and ‘encysts’ in the foot, impeding the cockle’s digging behaviour”**

Son of a beach

Even for parasites, though, life is not always easy. Take, for example, the trematode worm *Curtuteria australis*. It lives in cockles in coastal areas of New Zealand. This time, the parasite needs to infect a marine bird, like an oystercatcher, to sexually reproduce. The snag is that oystercatchers and other marine birds feed on a range of prey near the beach, such as fish, starfish, polychaete worms, and bivalves like cockles, but preferably on whichever food is most easily accessible. This can pose a problem for *C. australis* as...
its cockle host can hide. This sometimes makes them harder to find than other prey so the birds may not feed on them. To remedy this situation, the parasite has a devious way of putting cockles at the top of the menu.

Cockles hide from predators by burying themselves in the sediments using a big muscle called the ‘foot’. Thus, all that *C. australis* does is manipulate the digging behaviour of the cockle so that it can no longer bury itself. To do this, the parasite cunningly infects and ‘encysts’ in the foot, impeding the cockle’s digging behaviour. The more cysts there are in the foot, the more rigid it becomes, and consequently the harder it becomes for the cockle to bury itself. Conveniently enough though, the cysts do still allow the cockle to ‘unbury’ itself quite easily. This wouldn’t always be a problem for the host; cockles seldom come out of the sediment anyway and don’t need to rebury themselves often. However, once in a while, the cockle will try to find a better place for feeding, and that is when, after relocating, it finds itself laying helplessly on the sediment and unable to dig – an easy prey for a passing bird. When a bird then eats the cockle, *C. australis* can mate and complete its life cycle, just like the rat-cat case.

**“Once in a while, the cockle will try to find a better place for feeding, and that is when, after relocating, it finds itself laying helplessly on the sediment and unable to dig – an easy prey for a passing bird”**

**Unfore-sea-n occurrences**

There is yet another complication in *C. australis*’s plans: birds are not the only ones looking for a tasty meal. There are plenty of fish in the sea, literally, who will not let an easy snack pass by. Unfortunately for the parasite, it cannot reproduce, or even survive,
in fish; this is what they call a dead end for the parasite. So how does *C. australis* make sure it ends up in a bird and not a fish? As far as we know, it can't. However, theoretically, there are several ways in which the parasite could overcome the problem of being eaten by the wrong host.

One option for *C. australis* is showing an 'environment-dependent response'. This means that in beaches where birds feed mainly on cockles (and other bivalves), there's a good chance that at some point the cockle will be eaten by a bird, regardless of whether it's buried or not. In this scenario, the parasite doesn't need to impair cockle-burying too much – it just encysts in different tissues and leaves the foot alone, minimising the chances of being eaten by a dead-end host. Conversely, in environments where there is plenty of other easily accessible prey, the buried cockles are less likely to be eaten by a bird; here it would be better for the parasite's chances to heavily sabotage the burying behaviour of the cockle. Even if that means risking being eaten by the wrong predator.

Another option is that there's a temporal component to the host manipulation. This is possible if the different predators feed at different times of the day or during different times of the year. While the birds might feed by day because they are visual predators, the fish may feed during the night to avoid themselves being eaten (by the birds). This variation in suitable and non-suitable (dead-end) hosts during the day could prompt the parasite to make the cockle surface during the day, but bury itself during the night. This trick would probably require a bit more advanced host manipulation.

**A heated relationship**

Similar to *C. australis* manipulating its cockle host, many other parasites can direct their host’s behaviour. They do this in many different ways: some excrete hormones, others directly affect the bodily condition of the host (like *C. australis*), and some will affect gene expression. In my own research, I study host-parasite interactions with an extra level of complexity; my project focuses on how the interaction between parasites and hosts is affected by changes in temperature, as well as the effect on the whole life cycle of the parasite. For this, I use *Schistocephalus solidus* – a parasite that infects stickleback fish and has a complex life cycle – and study the effect of temperature on each of *S. solidus* life stages in the lab. This project is generating detailed data that can then be used to inform mathematical models and make predictions. This will help to uncover how changing environments are altering the millions of years old arms race between hosts and parasites.

**“In my own research, I study host-parasite interactions with an extra level of complexity”**

Boris W. Berkhout is a PhD student in the Department for Neuroscience, Psychology and Behaviour.
As you’ve been in office here for over a year, what is your main focus for developing the research community at the University of Leicester?

Before I started as Vice-Chancellor, I heard about some of the impressive research going on at the University of Leicester; the institution has a global reputation in some areas so you can’t miss it! Having been here for over a year now and having met a lot of people across the various departments, my positive opinion of the research at the University has only grown.

We are a highly research-intensive university; therefore, my main focus is increasing our excellence in research. In line with this aim, we are launching four new research institutes. The institutes accommodate four areas of research: precision medicine, structural biology and chemistry, creative economics, and space and earth observation. These are not just areas of research that we are involved in, but areas in which we are world-leading. These new institutes are also designed to be very interdisciplinary, so critically we want to make sure people across different disciplines get together more often to talk about their work.

We also want academics and research students to be bolder, more confident about the work that they are doing.

In addition to your career in academic research, you have held many leading roles on research councils and advisory bodies worldwide. What personally inspired you to go down this path, and is there anything you miss about research?

I came into this career as an academic, and I loved my career. I’ll be honest - I could never have imagined giving up being an academic; it was just a joy to be able to wake up in the morning with an idea and go into the office and study it. But gradually the group of people I was managing grew, so a lot of the work became more about management than research per se.

When the opportunity at the Economic and Social Research Council (ESRC) arose, I couldn’t turn it down. There is only one ESRC job out there in the UK. It was a privilege to be offered this fantastic chance to make real impact and the idea that I could help improve the way Social Science is managed in the UK was a real driving force behind my decision. After running the ESRC with a fairly big budget and having experience in large international bodies such as Science Europe, you start to enjoy the imagination that is needed to deliver change and improvement at the top of these organisations.

How do you feel your scientific background influences how you make decisions in the organisations?

I think there are a number of answers to that. One of the things that academia teaches you is to be evidence-based; that you really want to try and rely on evidence to make your judgments. It teaches you to question, to not necessarily accept the anecdotes and urban myths that float around. Research teaches you how to be imaginative, how to generate good ideas, and to innovate. I think you develop these practical skills as an academic, and that is probably true regardless of what discipline you come from.
Come together. We are part of this unusual community; we are and that is fantastic. It really does shape the look, the feel, and come from outside the EU, so we are a very diverse community University and the city. Around a third of our campus students

I am extremely proud of the multi-cultural nature of the University as it is such a fantastic institution. I think many people are aware, but Leicester as a university, and indeed Leicester as a city, can do more to promote itself, shouting from the rooftops about the fantastic things we are doing. Thankfully, topical events such as Leicester City Football Club’s recent success and the discovery of King Richard III have drawn a lot of attention to us. I think developments like these are really putting Leicester on the map.

There are also practical ways to leave an impact. I hope we are going to come up with some ambitious plans to transform the campus; although there are some really wonderful buildings, there are also areas that we can improve. We hope to create the National Space Park, by the National Space Centre on the other side of town. If the development comes off, it will be a second campus for the University, a really big development done in partnership with the city, local businesses, and major international space and earth observation businesses. So there are quite a lot of big schemes we have planned for the next few years.

Leicester as a university, and indeed Leicester as a city, can do more to promote itself, shouting from the rooftops about the fantastic things we are doing.

How do you expect international collaborations will help our research output?

There are all sorts of ways that international collaborations can transform our research output. We know from citation analyses, for example, that academic papers involving international collaborators are cited far more than papers lacking them. Part of the reason for this is because people don’t collaborate internationally unless it is worthwhile, making your work appear more attractive as a result. So, I would like to see us thinking about how those international partnerships should develop, how we build really deep relationships with other universities, not only at the institutional level, but also at the level of individual academics.

Leicester is famous for its ethnically diverse population. Can you explain the importance of this to the University of Leicester?

I am extremely proud of the multi-cultural nature of the University and the city. Around a third of our campus students come from outside the EU, so we are a very diverse community and that is fantastic. It really does shape the look, the feel, and the way we do things at this institution. We are very keen to promote diversity and think about the ways that different groups come together. We are part of this unusual community; we are one of the few cities in the UK without a majority White British demographic. So that’s a real opportunity for us here at Leicester that not all universities have.

In addition to cultural diversity, how do you think we can continue to improve gender equality at the University of Leicester, especially in research?

I think it is a really critical issue. A gender pay gap exists at our university and at every other university in the UK at the moment. One of the things we have already done is to commission an external review of our gender pay differences, to examine how we have arrived at them and assess whether they are unfair or not. Of course it is true that men earn more than women; this may be partly explained by the fact the types of jobs that men and women are doing here overall. You also have to look at the balance of men and women across different academic disciplines. If, after taking these sorts of factors into account we still find that there is a gender pay gap, then we will have to think hard about how to resolve it.

HeForShe is about getting men to take more responsibility in addressing some of the gender inequality that we see.

I’m happy to say that we are playing a leading role in the United Nations HeForShe movement which aims to recruit more men to advocate for gender equality. HeForShe has what they call a ‘10 x 10 x 10’ approach: ten businesses (including Barclays, Vodafone and Twitter), ten national leaders (including the Prime Ministers of Japan, Iceland and Sweden), and ten universities (including Leicester) around the world who are championing this movement. HeForShe is about getting men to take more responsibility in addressing some of the gender inequality that we see. I think this is vital; of course we want women to campaign around this issue, but we also need men to realise that it’s a serious issue too.

We’ve already done a lot of work by putting more women on our top committees and making sure there is a reasonable gender balance, and we are encouraging every committee to think carefully about the gender issues that we know are important for us to take into account.

If I am honest though, I think an even bigger issue for universities is ethnic diversity. Sadly, despite the fact that we have a hugely multicultural city and student population, we still have far fewer people from minority ethnic groups working at the University than we really should have. There are many issues around diversity more generally, both gender and ethnic, which I think we have to consider.

Do you have any closing remarks for our readers?

I spent a little bit of time recently working with Universities UK on the whole issue of Brexit and whether the UK should withdraw from Europe. I have spent a lot of time in Europe; I was president for Science Europe in Brussels and I spent a lot of time engaging with the European Commissioner, for instance. There is no question that some things could be done better in the EU, just like any administration, but from the University’s point of view I genuinely believe we are better off being part of a European community. While I wouldn’t want to influence how your readers vote, I would want to encourage them to vote. It’s really important that they make their voices heard.
Lungs: The Forgotten Organ

Research into lung diseases—the third biggest cause of death in the UK—isn’t receiving the attention and funding that it needs, and Dr Katy Roach is one researcher who would like this to change. In this piece for Frontier, she discusses why we forget about lung diseases and how the University of Leicester is working to place them back in the spotlight.

Have you ever found yourself gasping for breath and sounding worryingly similar to Darth Vader by the time you reached the top of the stairs? Or have you been forced to run for a bus and found, somewhat dismally, that your lungs are about to explode when you overdo it in the gym? Or have you been forced to run for a bus and found, somewhat dismayingly, that you’re huffing and puffing more than you’d like? Whatever your lifestyle and no matter your age, at some point in your life you will have suffered from shortness of breath. For those of us who have experienced it, breathlessness can be debilitating and the uncomfortable recovery can last for a matter of seconds to several minutes. Often we can reassuringly attribute our breathlessness to overestimating our fitness levels. But imagine if your shortness of breath wasn’t caused by overexertion; imagine if all it took was for you to speak a few words while having a conversation, or walking a few metres to the bathroom, or even when lying still trying to get to sleep. Breathlessness can be terrifying, but importantly it can ultimately become disabling and herald a rapid decline in quality of life and health.

As we’ve all been well aware since the moment we took our first breath, we require a continued supply of oxygen to survive. There are over 37 trillion cells in your body and every one of them requires oxygen to perform cellular respiration, a process that allows the cell to convert sugars into energy. The lungs themselves are a part of an incredibly complex organ system aptly named the “respiratory system”. There are three major components of this system: the airways, the surrounding lung tissues, and the muscles, which enable the lungs to inflate and deflate. While our lungs can be strengthened by activities such as aerobic exercise and deep breathing, they are extremely susceptible to damage by hazards such as cigarette smoke and dust inhalation. But despite the paramount importance of our lungs for our quality of life and health, why is respiratory research significantly underfunded?

Do we blame the smokers?

The unfortunate fact of the matter is that smoking-related lung diseases suffer from a heavy societal stigma; smoking is voluntary, and therefore the resulting disease is considered to be self-inflicted. However, many thousands of people who suffer from life-threatening lung diseases have either never smoked or given up years, even decades before the diagnosis was given. Take, for example, the wife of the British BBC journalist Robert Peston, who became a victim of lung cancer aged 51 despite never touching a cigarette in her life. She represents just one of 6,000 non-smokers who are diagnosed with lung cancer each year in the UK.

Many thousands of people who suffer from life-threatening lung diseases have either never smoked or given up years, even decades before the diagnosis was given

But of course, respiratory research doesn’t just focus on smoking-associated diseases such as lung cancer and emphysema. Insufficient funding also affects asthma, a disease extremely common in both adults and children, which can be severe enough to cause hospitalisation and necessitate the administration of strong drugs with harmful side-effects. Incapacitating and fatal inherited conditions such as cystic fibrosis, which kills at least two people every week, also receive inadequate support. Shockingly, one in 25 of us carry the disease gene without even knowing.

Are lung diseases more uncommon than other diseases?

The ‘Respiratory Health of the Nation’ report released in 2012 states that respiratory disease is the third most common cause of death in the UK, accounting for 20% of all deaths. This places respiratory diseases behind non-respiratory cancers (23%) and cardiovascular disease (28%). To put this into context, 35,000 people die from lung cancer every year, in contrast to 16,000 deaths caused by
Charity-driven donations for cardiovascular research clearly surpass the support for any lung-based disease. But why is this so? Are not cardiovascular diseases just as often, if not more so, caused by voluntary lifestyle choices, such as an unhealthy diet, excessive alcohol consumption, smoking and lack of physical activity? What explains this apparent sympathy for heart disease and not for the lungs?

“In T ime there must also be a collective transformation of our society’s perception of respiratory diseases”

What does the University of Leicester think?

Here at the University of Leicester, we are determined to ensure the lungs are not forgotten or overlooked. With a dedicated team of academics, clinicians and nurses spread across the main University campus and the hospitals including Leicester Royal Infirmary and Glenfield Hospital, the University of Leicester has become one of the main centres for respiratory research in the UK. Our focus encompasses research into the pathogenesis and management of airways diseases, including lung infections, tuberculosis and cancers. In particular, the Institute of Lung Health (ILH) at Glenfield hospital has benefited enormously from a multi-million pound government investment by the National Institute for Health research (NIHR). This essential funding led to the establishment of the Leicester Respiratory Biomedical Research Unit, a partnership between the University of Leicester and the University of Hospitals of Leicester NHS trust, which brings together respiratory research and clinical activity in Leicester. The ILH alone have published over 300 research papers and attracted over £60 million in research funding since 2006.

“The University of Leicester has become one of the main centres for respiratory research in the UK”

While encouraging, this progress is still not enough. With lung diseases becoming more prevalent and an increasing economic burden, there needs to be a change in the strategic priorities of government funding for respiratory research. However, perhaps more importantly, there must also be a collective transformation of our society’s perception of respiratory diseases. The concept of blame must be eradicated; the nation must become sympathetic to support those who are suffering. The lungs should not be forgotten.

So next time you run a marathon, bake a cake or leap out of a plane for charity perhaps consider donating to a respiratory charity, because, as it turns out, none of us can live without our lungs.

Dr Katy Roach is a Senior Researcher in the Department of Infection, Immunity and Inflammation.
“A Fit of Absence of Mind?”
Learning about British Imperialism in the 21st Century

The British Empire was instrumental in shaping the modern world as we know it. Despite its significance for today, controversies rage over how we should teach it to younger generations. Writing for Frontier, Dr Adam D. Burns discusses his recent investigations into the different educational factors influencing students’ perceptions of the British Empire.

The title of this piece quotes the Victorian historian J. R. Seeley, who wrote that Britain acquired its empire in a “fit of absence of mind,” a phrase that has arisen time and again over the years. However, the focus of my research is not to establish how or why Britain gained and maintained an empire, but whether those who live in Britain today are just as absent-minded in their understanding of British imperialism. As the historian, Antony Beevor, puts it: “Teaching the history of the British empire links in with that of the world: for better and for worse, the empire made us what we are, forming our national identity. A country that does not understand its own history is unlikely to respect that of others”. If this is indeed the case, then how students in British schools today come to understand empire is a question of substance, yet it is a question which up to this point has been largely regarded ideologically and rhetorically.

Controlling the Curriculum
When exploring the existing literature surrounding the teaching of History in schools in England (rather than British ones, due to the separate UK education systems), what becomes abundantly clear is that a grand debate recurs across the years concerning who exactly ‘controls’ the History curriculum. As the government of the day can manipulate education policy and the National Curriculum for separate subjects, one might say that they are able to control History. Such a power raises thoughts of Prime Minister (and historian) Winston Churchill’s famous words: “History will judge us kindly… because I shall write the history”. However, even if not all history books are written by politicians, there are many, particularly those in the more left-leaning media, who feel that politicians have...
attempted to reform the History curriculum for ideological and manipulative purposes. When Michael Gove invited historian Niall Ferguson to help revise the History curriculum back in 2010, an article in the New Statesman stated bluntly that: “The Tories want our children to be proud of Britain’s imperial past”. Similar criticisms have been levied more recently at Japanese Prime Minister Shinzo Abe, who has been accused of attempting to erase the darker side of Japanese imperialism from the history books. What many such commentators fail to acknowledge, however, is that a curriculum is not simply a syllabus for transmission to students, but rather a far more complex process open to a range of mediating influences, such as family, peers, teachers and the media, that occur between the writing of the curriculum document and the formation of a student’s understanding.

Surveying students and teachers

Although catalysed by the political debates surrounding the reforms to the History curriculum during the UK coalition government of 2010-2015, my research seeks to go beyond the ideological debate and put the question of how students come to understand imperial history to the students and teachers who deal with the subject on a day-to-day basis. Using a variety of methods, including questionnaires, interviews and focus groups, my study seeks to look more closely at core issues that the secondary literature has raised. I have carried out this research with a number of sixth-form groups that study British imperial history in three different sites: a state sixth-form college, a state comprehensive school, and an independent school. The sorts of questions the study seeks to explore are those such as: How significant is imperial history given the multitude of other histories that are absent from the curriculum? How important is it in a post-imperial, multicultural Britain? What roles do modes of multifaceted mediation play in filtering students’ ideas of empire?

“Surveying students and teachers”

Student reactions to portrayals of the British Empire

To begin with, questionnaires were distributed to students taking either AS or A Level History courses which focused on British imperialism. The questionnaires contained two images that prompted reflections from the students and what follows here is a variety of the students’ unfiltered responses.

Responses to “Negro Dance”

The first image provided to students was an 1836 Lithograph of West Indies plantation workers dancing, which elicited a wide variety of responses in answer to the question: “What does this source tell us about the nature of the British Empire?” Some students saw imperial subjects happy under British rule: ‘It shows...”

“I have carried out this research with a number of sixth-form groups that study British imperial history in three different sites”
the people celebrating which you can imply in terms of how the empire ruled it was good and liked,’ “This implies that the British Empire was not oppressive,’ ‘There appears to be no form of repression or sadness [sic] within this village, which differs from my previous thoughts upon the empire, a place I thought was doomed to failure’. Others suggested that the image represented the empire as a place that allowed colonised peoples to maintain their cultural/ethnic identity: ‘This picture shows that traditions don’t change with a new leader but it also shows that the white and blacks hadn’t mixed,’ and ‘It shows that the Africans as part of the British Empire kept some of their traditional values’. However, many students saw in the image a strongly negative view of British imperialism: ‘Non-British ethnicities living in a pitiable situation, meanwhile in the back of the image, there seems to be a rich/good house, making the contrast more remarkable,’ ‘Seems patronising to black people: British Empire patronised other races and belittled their ways/customs,’ and ‘This idea tells us that the nature of the British Empire was one to hold power over others by making them a lesser being than the British’.

Responses to an image of British officers

The second image provided to the students was an 1878 photograph of British officers most likely taken while on campaign in the Second Afghan War. Some saw the image as a projection of British strength and superiority: ‘The nature of the British Empire seems to be a strong nation with a sense of superiority and power as the men are very well-equipped, the ones that are stood are standing tall and confident and the men in the background don’t seem to be British and are standing far away watching British Glory,’ “The British Empire was all about its hierarchy, the image of the empire was important, and they ruled or put people in power that seemed to have the years and experience behind them,’ and ‘I think the British Empire relied an awful lot on their image as a whole and saw that as the most important thing’. Others saw the image as illustrating positive traits within the empire: ‘You can imply from this the empire was good because they are looking after their officers. They also were proud by displaying their badges which shows they’re happy to be involved in the empire, which again highlights it as a positive one,’ ‘The British empire appears to be united with both British and Indians in this picture working together,’ and ‘They were proud of what had been accomplished’. Again, however, there were those who saw the image as a primarily negative image of British imperialism: ‘Only the pure white British were counted as British,’ ‘All white – being British meant you were white – not a multi-racial nation yet,’ and ‘…the British didn’t like the idea of having Indian people having the same status of power as they did’.

“Others suggested that the image represented the empire as a place that allowed colonised peoples to maintain their cultural/ethnic identity”

An 1878 photograph of British officers from the Queen’s Own Guides

Adam D. Burns is the Head of History and Politics at Queen Elizabeth’s Hospital in Bristol. He completed a PhD in History at the University of Edinburgh in 2010 and is currently studying for a part-time EdD in History Education at Leicester
Initial thoughts

Even from this very general selection of student responses regarding these two images, it is clear that students studying the same or similar History courses drew markedly different conclusions from visual materials that they had never encountered before. Variations in responses not only occurred between different schools, but within the schools themselves. Although in my final study the student data will be dealt with in a far more structured and analytical manner, what this very raw data indicates from the start is that student responses to these images are far from homogenous, even after studying the same or very similar material at A Level. Indeed, it appears that many mediating factors (be they family, peers, teachers, media etc.) have a strong influence on students beyond the classroom, impacting their understanding of the British Empire. Although such initial conclusions might prove overly simplistic when the data is explored further, what the raw data does suggest is that the formation of student ideas about British imperialism is far more complex than a specified curriculum can account for. Whatever the reasons for this, there are clearly a range of influences between the designs of politicians and the realities of education that are often overlooked. My hope is that when further analysed and then compared with data from student focus groups, and interviews with teachers, my findings will provide some intriguing starting points for further investigation into how students understand the British Empire in the twenty-first century.

“What this very raw data indicates from the start is that student responses to these images are far from homogenous”

Pomp and splendour: the Viceroy and Vicereine of India ride on an elephant in Delhi, 1902
Monoclonal or Polyclonal… or Neither?

Antibodies are essential weapons in the immune system because they seek out and stick to specific targets, cell membrane proteins of invading microbes. Though this property also makes them very useful for finding target molecules in the lab, there is also a pressing need for refinement in antibody-based techniques. Dr Greer Arthur explains why.

Antibodies for the lab

For the purposes of research, this phenomenon has been harnessed by challenging animals with target molecules, which act as antigens, and then harvesting the ensuing reservoir of target-specific antibodies. For decades, this is how polyclonal antibodies have been produced. An animal, such as a rabbit or sheep, for instance, is injected with an antigen, and after allowing an immune response to build, the serum containing the antibodies is collected. Next, the antibodies are (often) purified according to what they’re attracted to, and then packaged up and used as a reagent for immunostaining in an experimental or diagnostic setup.

Room for improvement?

As efficient and valid as this process seems, it bears several inherent problems. As described by Andrew Bradbury and Andreas Plückthun in the scientific journal Nature last year, with the support of over one hundred co-signatories, only a small proportion of antibodies in the polyclonal “soup” are specific for the original injected target, since the collected serum will inevitably contain other predestined antibodies. Furthermore, little normalisation of the proportion and specificity of antibodies can be achieved between each animal and each immunisation, making batches highly variable and challenging to validate. Selectivity of the polyclonal serum can be gauged, to some extent, by comparing their binding ability with that of control antibodies to the same sample. Control antibodies are a mixture of antibody proteins generated in the same species of animal, but unlike the primary antibody, they were not raised against the same, specific antigen, therefore should not bind to the target. However, since corresponding controls are not necessarily produced from the same animal prior to immunisation, the validity of this comparison is restricted.

Strong and specific defences

Antibodies are neat little proteins with a unique ability to seek out, recognise and bind to particular antigens. More specifically, antibodies bind to explicit regions of the antigen, known as epitopes. Antigens and their epitopes are not exclusively proteins; polysaccharides and lipids can also behave like antigens, for example. Antigens are simply a group of molecules that would, in vivo (in the body), be recognised as foreign by the immune system, and would therefore trigger an immune response.

“When we encounter an antigen for the first time, our immune system designs and assembles the antibodies from fresh”

In humans, we manufacture our own antibodies based on which antigens we’re exposed to, and thereby what our immune system realises it needs to protect us against. When we encounter an antigen for the first time, our immune system designs and assembles the antibodies from fresh, so that we become primed and prepared for the next assault.

Importantly, we only produce antibodies as and when we need them, a quirk that remains useful for a number of clinical applications, such as vaccinating against specific infectious agents. By injecting an individual with an antigenic substance, the immune system is encouraged to produce a targeted response, including antibodies with a specific affinity for that exact antigen.
Sources of monoclonal antibodies are relatively fragile; hybridoma cell lines are as susceptible to dying or defrosting complications as any other type of cell, and re-establishing the same cell line capable of manufacturing exactly the same antibody is challenging. As noted by Bradbury and Plückthun in *Nature*, antibody genes can also be lost by the cells, and without vigilant characterisation, the spectrum of specificity of each batch of antibodies can risk being translated into unreliable and unreproducible research findings. In fact, the precise specificity of most monoclonal antibodies remains unknown. While authorities such as the US Food and Drug Agency ensure thorough validation before antibodies reach the human participants of clinical trials, the gargantuan remainder of the research world is still vulnerable to poor and variable antibody reagents.

### Taking antibodies to the next level

According to Bradbury, Plückthun and their 110 co-signatories, another step up from monoclonal antibodies is long overdue. Delays and the persistence of poor reagents are becoming ever more costly to the advancement of research and the pockets of funding agencies. It is in all of our interests to adapt and move forward – the direction in which science was always meant to flow.

The answer? As well as filtering out all the poorly characterised, unreliable antibodies, leads in the field are stretching towards the design and commercial manufacture of recombinant antibodies. Unlike monoclonal antibodies, which still rely on a mouse’s immune system to do all the designing, recombinant antibodies are engineered from precise DNA sequences encoding the exact antibody structure needed. If antibody sequences were made publicly accessible and validated to a high immunological standard, researchers would have absolute confidence in knowing what their antibody reagents were capable of binding to.

Rather than opting to simply trust the manufacturer’s validation procedures, or even turning a blind eye to the possibility that a better antibody is needed for the sake of convenient data, researchers can enforce this transition by choosing higher quality reagents: recombinant over monoclonal, and monoclonal over polyclonal. Likewise, publishers and funding administrations could impose a minimum requirement on the standard of reagents. Just as databases such as the UCSC Genome Browser have indisputably enriched genetics-based research, scientists and biotech companies could join forces to produce databases with characterised, published recombinant sequences. This would in turn enhance all of our data and get us the real results we’re all looking for.

“Researchers can enforce this transition by choosing higher quality reagents: recombinant over monoclonal, and monoclonal over polyclonal”

**Meet Next Issue’s Researchers…**

**Name:** Andy Lamb  
**Department:** School of Archaeology and Ancient History  
**Year of study:** 3rd year

Coming from a family which is Scottish on one side and English on the other, growing up I was always curious about cultural differences between closely related groups. Combined with a long-lasting interest in the European Iron Age (due in no small part to *Asterix* comics), I began to specialise in mortuary archaeology in my undergraduate degree.

My current research focuses on the southern counties of England between c. 500 BC and AD 70, examining human remains from the area and associated variables (grave goods, context of deposition, location in the landscape etc.).

In terms of broader research impact, I hope to demonstrate that, during this period in prehistory, our islands were not isolated from developments on the continent, despite what is currently argued by the majority.

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**Name:** Jamie McCarthy  
**Department:** Infection, Immunity and Inflammation.  
**Year of study:** 2nd Year

Throughout my education, I have always been drawn in by the constant battle between our immune system and the microorganisms intending to do us harm. I decided to side with the ‘good guys’ in this evolutionary arms race and studied Immunology at Master’s level. Here I was exposed to the influence our immune cells have over several diseases, such as Asthma.

I am studying the role of Group 2 Innate Lymphoid cells (ILC2s) in Asthma exacerbations. These are a relatively recently discovered innate immune cell, and are early responders to signs of danger within the body.

Our understanding of ILC2 biology is in a constant state of flux, a consequence of the relative short time since their discovery and the large number of research groups carrying out work in this field. I hope my work will leave us able to better characterise these cells and further our understanding of the role they play in both health and disease.

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**Name:** Simon Joyce  
**Department:** Astronomy  
**Year of study:** 2nd Year

When I was in primary school, I was given a book about planets and ever since then, I have been fascinated by astronomy.

I am now in the second year of a PhD at Leicester studying white dwarf stars. One of the aspects I find most interesting is that white dwarfs are the remains of dead stars so they can tell us a lot about the history of the galaxy. But as well as that, they give us glimpse of the future because the majority of stars alive today will eventually become white dwarfs.

I am currently using data taken by the Hubble space telescope to make very accurate measurements of the mass of Sirius B. White dwarfs, such as Sirius B provide a natural laboratory where we can study matter in an extreme environment. They can be used to test the laws of quantum mechanics because the material in them is under such high pressure that we see effects that we can’t study here on Earth.
What is on the other side of PhD graduation?

“Choose the life that is most useful, and habit will make it the most agreeable”
Francis Bacon.

The challenge for each of us remains to find the life that is “most useful” for our individual circumstances and disposition. Whilst a PhD may be part of the traditional route to an academic or research career, the imbalance between the numbers of people completing a PhD and the available academic and research opportunities mean that many successful PhD graduates may have to consider life beyond the research or academic environments.

“At the University of Leicester, we strive to provide professional development planning with some clear objectives”

For many PhD researchers (PGRs) there is a need to explore career opportunities beyond the academy. As part of our career management provision for PGRs at the University of Leicester, we strive to provide professional development planning with some clear objectives, specifically to enable participants to:

- review their professional development planning to date;
- overview their realistic career options;
- revisit their short, medium and long-term goals;
- put in place an action plan for their continuing professional development, with realistic timelines.

Straightforward? Unfortunately, one of the main challenges to the provision of professional development and career management training to the PGR population is lack of engagement, by PGRs in the training provided. Whilst this phenomenon is not fully understood, there are specific issues as to why PGRs do not attend such opportunities, and more general issues around why professionals in the wider working world do not attend such training.

One such issue, specific to the PGR community, is that for the most a PhD is a training to become an academic and/or researcher. Why then should they assume they are not going to be successful in achieving their desired outcome? As “motivational speaker” Tony Robbins advises, when it comes to following a career goal, one can either: (a) exclude all alternatives; or (b) have one or more alternative route(s) planned. During a recent Vitae Researcher Development conference one plenary brought this into sharp focus with a question about “workforce planning”. The point raised was that lack of apparent planning in terms of linking the number of PhD completions to workforce need (in the academic, research and wider world of work) as a determinant of the number of available PhD places.

Considering professional development planning more broadly, Jim Schreir, in a recent posting on “Careerrealism”, suggests there are five ways to get employees to take part in professional development training:

1. make it relevant, to the participants career situation;
2. set the stage, i.e. anticipate the participant question “why are we here”?
3. make it experiential, rather than powerpoint and words;
4. include self-assessments, by enabling participants to measure their own learning;
5. connect with instructors, by enabling participants to see that instructors have been through similar experiences and thus identify with them.

In conclusion there appears to be an assumption and a challenge in play here.

1. The assumption, by some PGRs, that engaging with professional development planning is only appropriate for those who have decided to look beyond academia and/or research for their future career. This contradicts the realities of the contemporary working world where academics and researchers need to develop a career plan and broad range of skills, e.g. enterprise skills being one example. Please see vitae.ac.uk and the expectations of the research councils for doctoral training centre applicants.

2. The challenge is for researcher developers to design and deliver professional development training that is relevant, contextualised, experiential and to make a connection with participants. For the PGR to choose the (professional) life that is “most agreeable” we need to work together to develop the professional development habit which is “most useful”.

“For the PGR to choose the (professional) life that is “most agreeable” we need to work together to develop the professional development habit which is “most useful””

Martin Coffey is Career Development Adviser for the Researcher Development Team at the University of Leicester
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