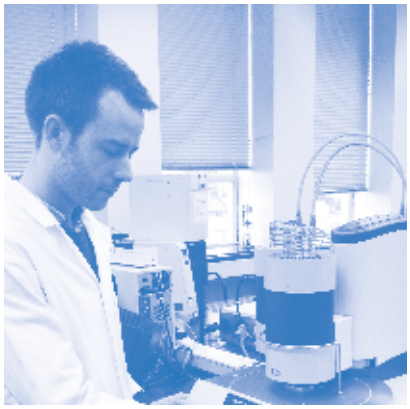

The Institute of Science & Technology

The Journal

The Journal

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Editor's welcome

Firstly, let me say a personal thank you to each of the many contributors to the 2012 - 2013 IST Journal.

In November of 2012 I was very much looking forward to giving an invited talk to the North East HEaTED regional meeting in Newcastle. Unfortunately, my attempt to get there was scuppered by the horrendous flooding;

Flooding closed the East Coast mainline south of Darlington

my train was first diverted and then cancelled. The weather as we all know has been weird and wet this year [there is an interesting little article in this edition which suggests the culprit]. Anyway, I had been invited to talk about "the changing role of the technician". A suitably apt title I thought because things do seem to be significantly changing the traditional role of the technician. For many it's also beginning to do so at a somewhat accelerated and unsettling pace. The drivers for this change are now wider than merely reorganising staff for efficiency or skilling up for new technology; its thrust is being firmly directed by the UK's future needs and the government's economic strategy.

There has been a plethora of papers published over the past few years which all, in one way or another, have identified the UK's need for more high quality technical skills in its workforce. Industry, it has to be said, has shouted this for a number of years, while the government has, it seems, spent a great deal of time and money commissioning report after report to investigate the perceived UK need! The latest "big" report to hit the coffee table is by Lord Heseltine; entitled "No stone unturned in pursuit of growth". In it Lord Heseltine outlines his impressive 89 point action plan, where a big chunk of it is directed toward mitigating the predicted UK shortage of high end technical skills. This is particularly important in the STEM (science, technology, engineering, and mathematics) sectors where there remain concerns that there will be a shortfall of graduates in filling the anticipated vacancies. The Royal Academy of Engineering estimate in their 2012 report, Jobs and Growth: the importance of engineering skills to the UK economy, that there will be a requirement for more than 100,000 STEM graduates per annum for the period 2012– 2020 and that this will not be met by newly graduating STEM students who currently number only about 90,000 per year. In fact the gap will be much wider than this because a significant proportion of STEM graduates will ultimately choose to go into non-STEM occupations. It is estimated, for example, that currently 26% of all engineering graduates don't go on to enter the engineering profession.

Lord Heseltine's report goes on to say "We have four of the six best universities in the world. Despite this, skills gaps are too wide at the intermediate and basic levels, including in maths, literacy and science. UK industry also appears to be relatively less skills intensive and employs fewer graduates in professional and technical occupations than its major competitors. No boom in growth can be achieved without a significant rethink as to how we develop skills in this country – both funding training and its delivery."

OK, not rocket science then, and by the way it's what the technical community have been saying for some years now. Anyway, as I began to recover from reading the 230 page report with the help of a couple of friendly aspirins I considered our UK technical community's changing environment, and wondered if I could help Lord Heseltine and his plan by offering my simple 4 "to do" point summary.

1. **Get really young kids really interested in real science and engineering.**

2. **Get more vocational opportunities (more jobs) and more routes to technical careers.**

3. **Get technician specialists and technician roles recognised in the UK as technician professionals.**

   Oh, and finally my last "to do" point (which rather unsurprisingly isn't mentioned in Lord Heseltine's paper, despite there being much made of the comparison between the UK's technical weakness, and Germany and Switzerland's technical strength).

4. **Pay professional technicians well for being good at what they do and commensurate with what they contribute to a successful economy.**

"By the way, the real cost of a degree in the UK is now estimated to be approaching £100,000 over a student's career lifetime. It's a worrying time indeed for young people looking to map out their career."

Best wishes for 2013,

Ian Moulson
Editor

Chairman's view

Recession, recession, recession! Yes, doom and gloom and then we had the cheery Christmas message in the Chancellor's Autumn Statement that it will not be until at least 2018 for the country's (structural) deficit to be wiped out. So another six years of austerity measures then. Not much to cheer about – well YES there is! The last twelve months has been full of so many positives for the technical community. The start of the year saw the Technicians Registration Scheme gathering momentum through the fine work of the Science Council. More success came with the Government's launch of the "Professional Technician". These two initiatives combined gave the technical community the recognition that they had been demanding for the last twenty years – Professional recognition and proven competency. In June the IST was awarded a licence by the Science Council to assess and accredit technicians accordingly.

July saw the highly successful inaugural PTSE Conference in Sheffield (see our Journal Summer 2012 issue). Following the conference the response from employers and employees across the sector to the professional registration of technical staff was excellent, with the first cohort of technicians receiving their certificates. To see these people being nationally recognised as professional technicians and accredited accordingly was so important for our community, and was a tribute to all those who have worked relentlessly over the years to achieve this recognition that technical staff deserve.

During the summer the IST and the University of Sheffield became partners in establishing the Professional Technical Training Scheme. This work entails all forms of training and development including career road mapping, an apprentice scheme, several technical training schemes and advanced specialist technical development.

This positive and ground breaking approach by the University of Sheffield and the IST led to further enhancement of the "Professional Technician" initiative (see the THE article issue 15-21 November 2012). This article has stimulated further debate with additional work being developed with other Universities who have joined our pilot for 2013.

These successes could not have been achieved without those members of the IST who have given their time to promoting and supporting the technical community. From the technicians who are members of the Executive and related committees to those who are our ambassadors, visiting other Universities and institutions to give talks on the registration scheme, explaining what the IST is doing for you, and how we mentor technicians in planning their current and future careers. Also all the office and backroom staff who work relentlessly to give so much more to you and the technical community and are not always given the recognition for their hard work and commitment. 2013 will be a difficult year but one of opportunity for the technical community, our sectors and the country. By the IST being part of the national framework for the Professional Technician and its members registering for either Registered Science Technician (RSci Tech) of the Registered Scientist (RSci) WE can make a vital contribution. Proven competency of a highly professional technical workforce gives the edge in attracting business, research and development funding which will make a significant contribution to income generation not only for our sectors but also nationally. This message also contributes towards our competitiveness in the international market and will help the country speed up the journey out of recession.

In 2013 the IST needs YOU to get involved at all levels, from regional support to being an IST ambassador. Would you like to be involved as a trainer or a mentor and use your wealth of experience to help other technical staff? Alternatively, could you be an assessor for the registration scheme maybe? Why not come out of retirement one day a week? There are many ways YOU can contribute to YOUR professional body; together we can make a difference. Remember, the IST runs with the support of technicians, for technicians, in all sectors and disciplines.

So, please contact me on *office@istonline.org.uk*. I look forward to your email and contribution in 2013.

With Best Wishes,

Terry Croft
Chairman

IST members' news

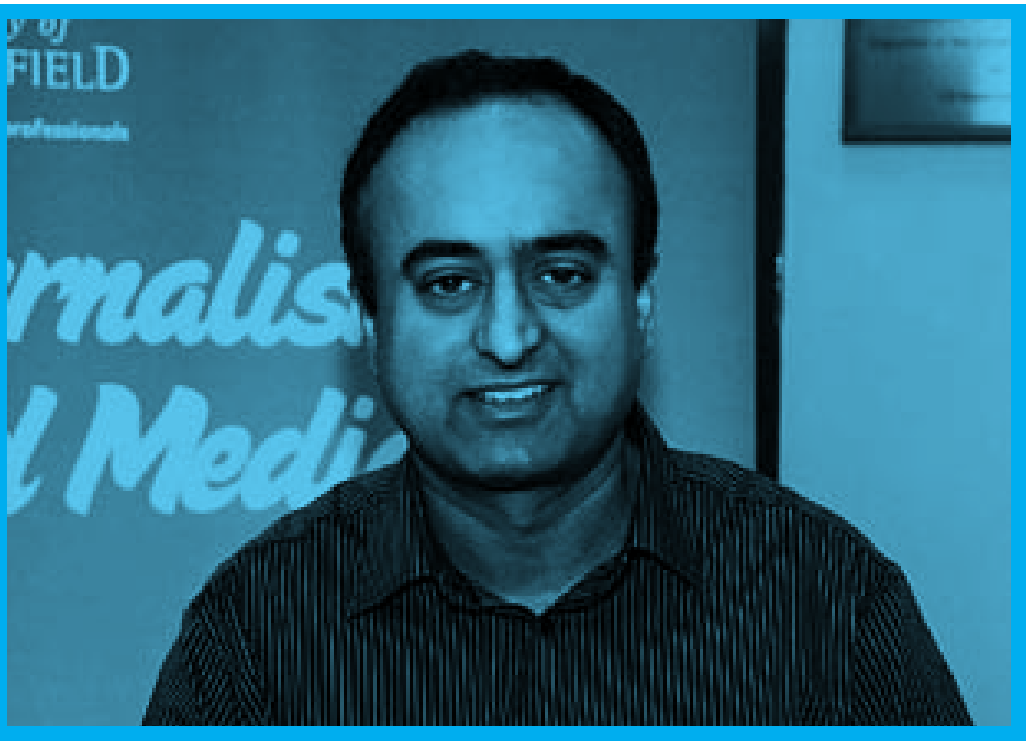
Gina Conroy receiving her Medal of Honour

Mrs. Gina Conroy, wife of Prof. David Conroy FIScT, and mother of Carlos Conroy MIScT, was distinguished on 19 October 2012 as the recipient of an important award in recognition of her

academic, ethical, and professional scientific contributions towards the betterment of humanity,

by the National University of Trujillo, Peru. The award, which consists of a Medal of Honour and an inscribed parchment, commemorates the "Golden Jubilee" of the Faculty of Biological Sciences, from which she first graduated as a Fisheries Biologist.

The public ceremony was presided over by the Rector of the University, in the presence of the Vice-Rector, Deans of Faculties, staff, family members, and friends. It took place in the beautifully ornate 16th century seminary founded in Spanish colonial times, and later reconstituted as the National University of Trujillo, post-independence, in 1824, which is still used for such important public ceremonies. Messages of congratulation have flooded in from her many colleagues in Latin America and elsewhere around the world. Mrs. Conroy is the co-author of a paper, together with her husband and son, which was published in the 2011 summer edition of the Journal of the Institute of Science and Technology.



Kuldip shows the way by becoming the first technical expert in the arts field appointed as an Institute Fellow.

THE University of Huddersfield's Kuldip Singh (pictured) is the first technical expert working in the field of arts and media to have been appointed a Fellow of the Institute of Science and Technology.

He heads a team which ensures that the increasingly advanced technology used by staff and teachers in the University's School of Music, Humanities and Media meets all the demands placed on it.

Following confirmation of Kuldip's Fellowship Terry Croft OBE FIScT, Chairman of the IST said: "The Institute of Science and Technology is uniquely an organisation run by technicians for technicians. We support these incredibly important staff in all areas, not just science but technologists in all fields. We were delighted to award Kuldip Fellowship status to recognise the excellent work he has done at Huddersfield and we are keen to recruit more members and fellows from Arts and Creative Media and to build a strong voice for them on a national scale.

He added: "We have recently been awarded Licensed Body status from the Science Council and are now able to provide professional recognition to technicians and specialists by awarding Registered Scientist and Registered Science Technician, but importantly we are also able to offer Registered Practitioner, a sister scheme for technicians working outside of science and look forward to working with Kuldip to help develop the professional status of technology staff working within creative arts-based disciplines."

The Lake House Meteorite

Colin and Judith Pillinger

Joseph Williams Lovibond was a colourful character as reported in the extensive review of his life and scientific and technical achievements by Alan Gall in the Summer 2010 issue of The IST Journal. Not only was he a well-known brewer, he developed the Tintometer comparator as a means of ensuring the quality of his products and he was a pioneer in the use of reinforced concrete as a building material. His contributions to the science of colour are still in use today.

As if that was not enough we have recently discovered that Lovibond had a role in the history of Meteoritics – the study of stones that fall from the sky. The extent to which he knew about meteorites, and hence his ability to recognise one, remains a mystery and is the subject of our ongoing research but his early career as a gold prospector suggests he had some geological knowledge. Photographic evidence shows that he certainly possessed a large meteorite; indeed he literally had to avoid it because it was strategically placed on the front doorstep of his impressive Wiltshire home, Lake House, near Salisbury.

The story starts in 1991 when the stone, a type called an ordinary chondrite, a sample of the oldest material (4.55 billion years old) making up the Solar System, was taken to the Natural History Museum (NHM) in London. Lake House was about to be sold and the descendents of the then owners, believing it to be the meteorite found by their grandfather, sought confirmation of its extra-terrestrial origin. Grandfather had bought the house around 1928 and there was no information as to whether the stone had fallen locally or been brought to the UK from abroad.

Very few British meteorites are known about – a total of just sixteen have been seen to fall on the mainland since 1795 when a fifty-six pound rock narrowly missed agricultural worker John Shipley at The Wold Cottage in Yorkshire. The Wold Cottage meteorite was a key happening in the study of meteorites.

It was the sample that convinced the world that stones really did fall from the sky and were not something that ignorant peasants made up.

Until recently there were no British “finds”, that is meteorites that have been found serendipitously, picked up as an unusual object then later identified by someone skilled in recognising their extraterrestrial nature. Fallen meteorites are usually spotted as different from native rocks because they have a component of iron metal. These specimens often turn out to be a bit of industrial slag, which also contains metallic iron. Whilst the metal content allows meteorites to be identified, it is this unusual characteristic that makes “finds”’ almost impossible to find in Britain. Our climate, warm and wet, causes a meteorite to weather, which is quite literally rust away. The accepted wisdom with respect to discovering a “find” in Britain has been that they could only survive for a short while before they would have disintegrated into a pile of dust. Whilst the Curator at the NHM confirmed the Lake House stone was a meteorite, the Museum took little interest in it, believing it was a common type of specimen probably returned to Britain from somewhere hot and dry, possibly India.

There is an exception to every rule and, in the case of meteorites found in Britain, it is a 30 gram specimen which had been recovered by archaeologists conducting a major excavation at the Danebury Iron Age hillfort near Stockbridge in Hampshire, 20 km east of Lake House, in the early 1970s. We had been studying the Danebury meteorite and found, by radiocarbon dating, that it had survived on Earth for 2350+/-120 years, almost unaltered. We concluded that, as it had been located in a chalk pit, the alkaline conditions had stabilised the iron thus minimising the effects of weathering.

It was thought that the Danebury and Lake House (meteorites are named after the place they are seen to fall or are found) might be related, i.e. as they were the same kind of meteorite, perhaps they were part of the same fall. So, with the owners’ permission, we started a study of the Lake House meteorite, first measuring its terrestrial residence age. Much to our surprise it was not the 2350 years we were expecting, but more than 30,000 years.

Nevertheless the Lake House meteorite was too big to ignore - it weighs almost 93kg (>200lbs, nearly two hundredweight) and it takes four strong men to move it. It could not have been collected without having the resources and a very considerable motivation or desire to do so.

At the very least you would have to know it was a meteorite or other interesting geological specimen and hence worth taking a lot of trouble to bring back from your travels. To consider the possible provenance of the meteorite from Lake House, we commenced an archive study alongside the on-going scientific examinations and analyses: a search for some key documentary history of the property, the people associated with it and their interests in particular their scientific knowledge that would allow them to recognise the stone as extraterrestrial in origin.

The breakthrough came with a Country Life magazine article; the publisher's picture collection and high-resolution images of the grand house showed that the Lake House meteorite wasn't grandfather's stone at all. It had been put on the front step in the time of Joseph Williams Lovibond's ownership of the house, some twenty years before the Bailey family owned Lake House.

The story however did not stop there. We traced the ownership of Lake House for more than four centuries. For much of that time it was the ancestral home of a family called Duke. In the early 1800s, the Reverend Edward Duke had been one of the pioneers of British archaeology, working with Sir Richard Colt Hoare and William Cunnington. His particular interest had been excavating the Bronze Age burial mounds of the Wiltshire Downs of which there were quite a few on his land, the Lake House estate. He went on to dig on his own but unfortunately was not as good as his mentors at keeping accurate and details notes of his activities and finds.

The various barrows, heaped up around 4000 years ago, are big piles of local Downland chalk plus any other stones that just happen to be lying around. So our hypothesis is that Edward Duke probably found the heavy, unusual-looking large stone in a barrow he was excavating. The chalk environment had ensured its survival from weathering, just as we have proved to be the case with the well-documented Danebury specimen. He does not appear to have added it to his private museum of his treasures, which were later auctioned. After storage out of the elements, Lovibond must have located it. During restoration of Lake House after he bought it from Duke's widow in 1897, Lovibond was careful to recover as much of the original building as possible, finding missing stones for the fireplace in an outbuilding in the grounds of Lake House. The stone was clearly considered interesting enough (by Lovibond?) to have pride of place in the Country Life photo shoot.

It still does not explain the more than twenty thousand years the meteorite had to survive before ancient Brits put it to use. A possible answer to that puzzle is that from 30,000 to 10,000 years ago Britain was locked in an Ice Age when the intense cold would have ensured there was little or no liquid water around to rust the iron in meteorites and destroy them. The same conditions prevail on Antarctica today where scientists from the USA and Japan have annual meteorite hunting expeditions.

Edward Duke's desire to collect things and Joseph Lovibond's prudence may well be the key to understanding the fascinating history of Britain's biggest meteorite that Lovibond had on his doorstep.

This article is abridged from the Royal Society Michael Faraday Prize Lecture given by Professor Colin Pillinger CBE FRS earlier this year.

Colin and Judith Pillinger, November 2012

The author and the meteorite: the descendants of Lt Col FGG and Lady Janet Bailey have made the meteorite accessible to a wide audience by placing it on long term loan with the Salisbury and South Wiltshire Museum. (Photograph Open University)

Lake House, Country Life 1908 (Photograph courtesy of Country Life)

Close up of the front door step at Lake House, Country Life 1908 (Photograph courtesy of Country Life)

3D television killer

Laurence Murphy

The broadcast television industry is preparing for another high definition standard to embed itself in programme production and distribution - 4K HDTV high definition with four times the picture information of full HD. The launch of this new 2D HD standard will significantly affect the rollout, expansion and projected market for stereoscopic television. Is 3DTV a format doomed to limp forward before quietly being dropped as new, less problematic formats evolve, or will it accelerate the launch of new technologies to establish itself as a real television delivery method?

Stereoscopic television has become the broadcast expression for two key markets, 3D sport acquisition and 3D cinema. Both of these core markets need 3D to be an effective and distinctive technology.

Sports media needs to expand its economic potential to offer premium higher tariff programme packages. The digital cinema industry needs 3D to succeed, as it needs the distinctive experience 3D offers compared to HD in the home. The most significant economic driver for 3D in the cinema industry is the need to combat large scale piracy and copyright infringement of its media. The protection 3D offers, inherent in its distribution and playback, to create secure digital rights management and a less vulnerable distribution chain.

These issues seem secondary to a key consideration which seems to be regularly overlooked. Does stereoscopic 3D add a significantly creative difference to 2D production? Is 3D appropriate as an acquisition and display method for large sections of core programme television output?

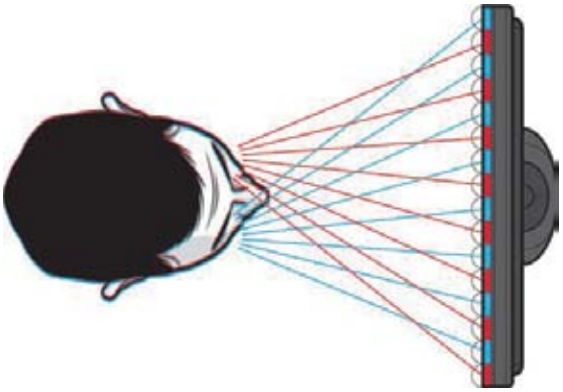
The broadcast companies have their reservations about 3D as a wide reach delivery method. Canal+, the French broadcaster, closed its 3D channel after only 18 months due to a slow uptake topping out at only 20,000 subscribers. This was attributed to poor market penetration of 3D screen sales and a lack of good quality varied programme output. Independent analysts Ovum, produced some concerning research for the companies already invested in 3D. In several interviews conducted with senior IT and business executives in the broadcast industry throughout Europe, North America and Asia-Pacific they were asked to rate their strategic priorities for 2011;

Production of 3D content and/or launch of 3D channels are the lowest priority for strategic investment. Fifty-three per cent of respondents said 3D content production was "not an important business consideration", the highest figure of all 11 investment areas. Meanwhile, no broadcasters in Europe or North America viewed 3D as a "critical investment area".

In conclusion with their findings, a lack of varied programme material along with ambivalence from the viewing public and the broadcast industry looks to severely limit the range and success of 3D as a delivery mechanism.




One of the key draw backs of this generation of 3D display technologies is an over dependence on glasses. Whether they are passive polarised similar to those used in cinemas, or synchronised active shutter glasses using a sync signal between the glasses and the display, the average viewer does not want to view hours of home TV wearing them.



The pro 3D lobby defend the technology by saying auto stereoscopic displays will turn 3D's fortunes around. A stereoscopic display uses advanced filtering and screen construction to display 3D without the need for glasses. I have sampled the best of the new breed of auto stereoscopic displays myself, in September 2012 at the IBC conference in Amsterdam. Whilst they are a significant improvement on the existing systems they are still vulnerable to the common weaknesses of the older systems.

The viewing angle at which you address the screen is limited. If you move whilst watching the image, the perceived image appears to shimmer or ripple as you move from one zone to another. In short, large auto stereoscopic displays are still problematic and need more development.

There is another technology that has increasing importance in the viewing experience and may also significantly affect the saturation of 3D as a home TV technology.

Second screen additional viewing is a new and significant development in the way the audience engages in an interactive way with the programme on the television.

Using iPads, tablets, smartphones and laptops, more and more viewers are able to connect with an augmented and more elaborate engagement method. Additional material, feedback and audience participation are being intertwined into mainstream broadcast production to fully embrace the social networking second screen model. However, there could be a major problem for 3DTV if this trend increases. It is virtually impossible to both engage with a 3D programme using 3D glasses and participate using a second 2D screen. This could be a more significant negative for 3D as a home technology than anything else.

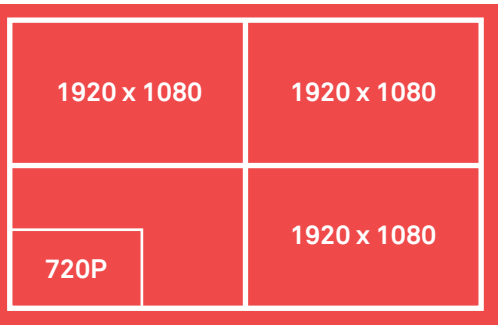
So is 3D the only new technology for broadcast television? Whilst 3D has been stalling and stuttering, larger 2DHD standards have been rapidly developing.

NHK, the Japanese broadcast company, has had a development project for a number of years to design and build Super Hi Vision; an 8K Ultra high definition standard. 8K has a resolution of 7680 × 4320 – 16 times the number of pixels of full 1920x1080 HD currently available to the mainstream market. The practicalities of 8K production have been tested recently at the Olympics in London 2012 with 8K pictures being transmitted live to Japan, and shown at venues across the UK.

David Wood, Head of New Media for the European Broadcasting Union (EBU), comments on the standardisation of UHDTV;

"This is the dawn of a new age for television that will bring unprecedented levels of realism and viewer enjoyment. It's a historic moment. Some years will pass before we see these systems in our homes, but come they will. The die is now cast..."

The prospect of 8K Television in the future is an intriguing one but neither economically or technically viable for at least the next ten years. However, as a bi-product of the 8K research and development, a lower UHDTV standard was also developed and is being deployed by companies like Samsung, Sony, LG, Toshiba and Panasonic.



4K displays have an active resolution of 3840 x 2160. 84 inch models will go on sale in the UK in the first quarter of 2013. The question we should be asking is whether this is a cynical attempt by manufacturers to recoup lost development revenues by creating yet another display line or is it a coherent standard with much wider appeal than stereoscopic 3D?
Will an 84 inch TV fit in the average living room? How far back will we have to sit to perceive the benefits of a 4K display?

A logical assumption is that if the display becomes larger, the viewing distance must increase proportionally. We were told as children not to sit too close to the television, as it would hurt our eyes.

The warning had a basis in fact as if you sat too close to a standard definition TV you would see the raster of the lines on the screen and your eyes could be strained. Viewing distances for high definition displays are generally three times the picture height, at this distance the pixel construction isn't visible. As there is four times the pixel density in a 4K display the viewing distance is reduced to 1.5 times the picture height. The knock on effect from an experiential point of view is that more of the screen fills our field of view and our peripheral vision, making 4K 2D viewing an immersive experience.

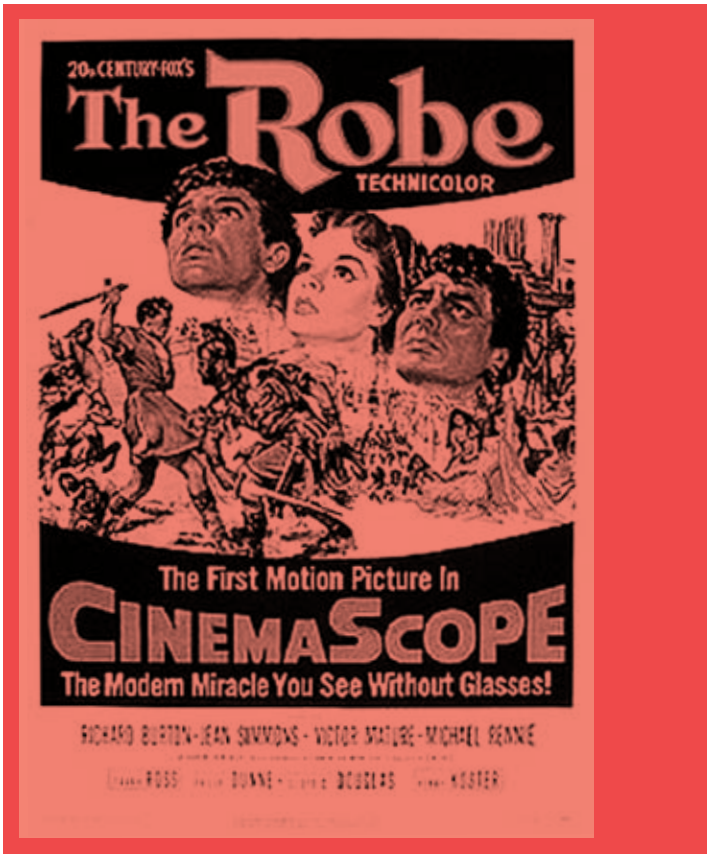
Film is on the decline as a medium for cinema production. The new generation of digital cinema cameras can produce both broadcast television programmes and cinema productions with more native resolution than 4K. The potential 4K programme material is already being generated on a much wider scale than 3D productions. With the prospect of the adoption of 4K as a premium level of television acquisition on a much larger scale, along with the prospect of affordable 84 inch displays within the next two years; 4K as a technology is receiving increased interest from the broadcast companies, cinema companies and the manufacturers.

There is a worrying historical president and parallel to the 3D v 4K conundrum facing the broadcasters and the public at the moment. In the golden age of 3D film production, 1952-1954, an expensive projection process and more importantly, the launch of a competing 2D large aspect standard – Cinemascope, killed off both the market and the economic support for 3D film production.

The 20th Century Fox feature The Robe (Henry Koster), released in 1953, was the first major feature film to use the newly developed 2.35:1 wide aspect ratio. The publicity posters even had a dig at the 3D film dependence on glasses.

Cinemascope was perceived as a more comfortable, visually impressive and deliverable cinematic mechanism on a large scale, leaving 3D in its wake. 3D may evolve but without the broadcasters onboard, who will create the content? My belief is that 3D will not disappear, as it has a clear potential market in immersive gaming technologies, but 4K also has designs within this industry.

If asked to nominate the system with the most potential for development and large scale deployment, I would suggest 4K is definitely the technology to watch in 2013.



Courtesy wikipedia

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Biotechnology in Nigeria

The inclusion of biotechnology as an option in Science Laboratory Technology training programs in Nigeria: a proposal

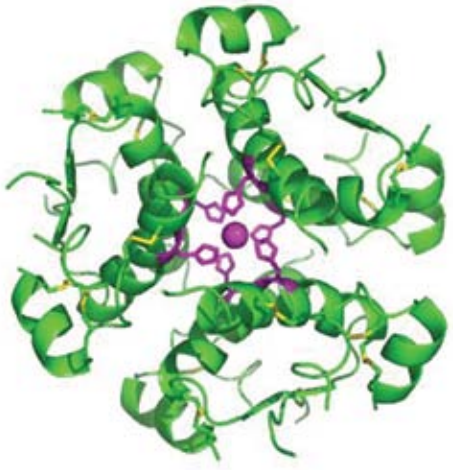
Olumide Adedokun Odeyemi

Introduction

Science and technology are two inseparable tools of socio-economic development. Amongst the various disciplines capable of moving Nigeria forward technologically is that of Science Laboratory Technology (SLT). It is a profession responsible for producing technicians, technologists and scientists whose workplaces are laboratories concerned with biological, chemical and physical sciences. However, Nigeria lags behind in the field of biotechnology, an area that has been developing elsewhere for over thirty years. One way to overcome this deficiency is by training staff who are capable of taking a leading role in bridging the existing gap between Nigeria and more developed countries.

Higher education is essential for the development of any nation, especially those with a poor economy. Manpower training and development through post-secondary education is a corporate responsibility of the country. Science and technology advancement can only take place with the development of human capacity to drive it forward. Acquisition of the knowledge and training needed for this advancement can be achieved through various post-secondary institutions nationwide. In Nigeria, higher education providers are classified as universities, polytechnics, monotechnics, colleges of education, and technical colleges at federal, state and private levels, respectively.

SLT is one of the pioneering professions in Nigeria. It dates back over sixty years at the University of Ibadan, the premier university of the country, where training started and was certified by the City and Guilds Institute, London. Due to development, the course is now offered as a fully-fledged degree in universities and offered as a diploma and higher diploma in various polytechnics. However, for the appropriate administration, the Nigerian Institute of Science Laboratory Technology (NISLT), with the secretariat at Samonda, Ibadan, was set up. Established in 1972, it fully took over SLT courses in 1984 after the withdrawal of City and Guilds as the examining body.



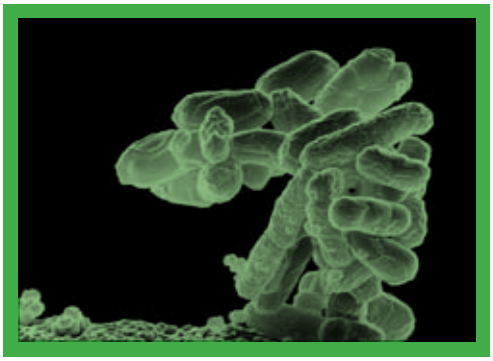
Computer-generated image of insulin hexamers highlighting the threefold symmetry, the zinc ions holding it together, and the histidine residues involved in zinc binding. Image courtesy Wikimedia Commons

The biotechnology option

The options making up the SLT program of study are: microbiology, biochemistry, chemistry, geology, and physics with an electronics option, at either Higher National Diploma (HND) or degree (BTech) level. However, global advancements in science and technology call for more options to be included with the SLT training programs.

This will help the nation to keep abreast of progress, ideally on par with technologically advanced countries.

Biotechnology involves direct or indirect manipulation of living organisms to produce products and services, and is a multipurpose discipline having its applications in medicine, agriculture and the environment (Odeyemi, 2011). It is one of the most rapidly advancing technologies globally in natural and life sciences, including chemical and bioprocess engineering. Nicholas (2008) has stated that ineffective leadership, coupled with poor funding and inadequate human capacity are factors militating against the growth of biotechnology in developing nations.



The bacterium Escherichia coli are routinely genetically engineered. Image courtesy Wikimedia Commons

In a bid to increase the awareness and control of biotechnology, the National Biotechnology Development Agency (NABDA) was set up by the Federal Government in 2005 (Yusuf et al, 2010). Although NABDA is meant to promote biotechnology awareness, collaboration with other science-oriented agencies, like NISLT, will go a long way to achieving this aim also.

Conclusion

There are many applications of biotechnology: to medical science, agriculture, industry and the environment. Nigeria has not yet tapped the potential of this rich field of endeavour. In order to do so, it must promote the study of biotechnology by offering a structured program as part of a SLT training scheme. The content of such a course could take a number of forms, such as that suggested here.

Author

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Proposed curriculum for the biotechnology option

Semester I	Topic
1	Introduction to biotechnology
2	Industrial molecular microbiology and biotechnology
3	Molecular genetics
4	Bioinformatics 1
5	Microbial genetics
6	Instrumentation
7	Molecular biology techniques 1

Semester II	Topic
1	Plant molecular biology
2	Animal molecular biology
3	Microbial biotechnology
4	Scientific communication I – writing research and grant proposals
5	Good research practice
6	Bioinformatics II
7	Molecular biology techniques II

Semester III	Topic
1	Research methodology in natural and life sciences
2	Genetic engineering
3	Student research I
4	Current developments in molecular biology research
5	Medical biotechnology
6	Agricultural biotechnology
7	Scientific communication II – writing, presentation and publication

Semester IV	Topic
1	Biotechnology management
2	Molecular epidemiology
3	Student research II
4	Seminar presentation
5	Ethical aspects of molecular biology and biotechnology

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Caffeine extraction

Study on the extraction of caffeine through distillation

Raffaele Conte

Abstract

The aim of this research is to compare the concentration of caffeine in current principal coffee based drinks, with that of a new type of extract obtained using a particular alembic distiller. This alternative method is designed to achieve a low-caffeine content beverage that could therefore be registered as a soft-drink. The process and results of the distilled coffee will be appraised against the UK/EU directives regarding beverages containing caffeine, to evaluate the viability of a possible future product.

Introduction

According to the definition of the International Organization for Standardization (ISO), coffee is the "fruits and seeds of plants of the genus Coffea, usually of the cultivated species, and the products from these fruits and seeds, in different stages of processing and use intended for human consumption" [1]. This term refers to a beverage made by the infusion, decoction, or percolation of the roasted, ground seeds of the tropical plant of the above mentioned genus, usually C. Arabica or C. Canephora / C. Robusta. The earliest evidence of coffee drinking appears in the middle of the fifteenth century, in the Sufi monasteries of the Yemen in southern Arabia [2]. Previously, coffee was known as "buna", a stimulant food in Ethiopia [3]. The coffee plant most probably originated in Africa and Madagascar. Early cultivation is reported in the Ethiopian highlands and also in Yemen [2]. The coffee plant species are a woody perennial evergreen dicotyledon that belongs to the Rubiaceae family.

Given their dimensions it is more accurate to describe them as coffee trees [4]. Despite the fact that there are several types of these plants, the world's production of coffee can be related with just two main species. These are, Coffea arabica, known as Arabica coffee (75-80 % of the production), and Coffea canephora, known as Robusta coffee (20 %). The fruits of these two varieties differ in terms of aroma and flavour. Robusta coffee beans tend to produce an inferior tasting beverage but with higher caffeine content, while the extract of the fruit of Arabica plants is recognized for its strong flavour [4].

This research of a new method of extraction of the caffeine is aimed toward the development of a system that can transfer a smaller concentration of the active molecule into the obtained beverage. It would thereby reduce the disparities due to the different botanical species and the heterogeneity of the factors analysed in the following paragraphs.

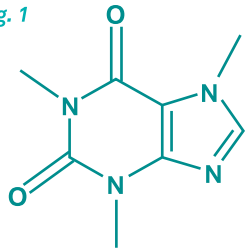
Components of the coffee extract and caffeine

The chemical composition of coffee is influenced by many elements such as the location, altitude, and weather, composition of the soil, cultivation, harvesting, the drying method used, and the quality of the roasting process [5]. Data extrapolated from literature reviews [6], express an average of these concentrations to statistically decrease the effect of the above mentioned factors, and are summarized in Table 1.

Table 1

	Chemical composition of coffee					
	Arabica green	Robusta green	Arabica roasted	Robusta roasted	Arabica instant	Arabica instant
Caffeine	1.3	2.3	1.2	2.4	2.5	3.8
Trigonelline	0.8	0.7	0.3	0.3	0.7	0.4
Carbohydrates	53.7	50.7	38	42	46.6	44.7
Chlorogenic acids	8.1	9.9	2.5	3.8	2.6	1.6
Lipids	15.2	9.4	17	11	0.11	0.26
Amino acids	11.1	11.8	7.5	7.5	6.2	6
Organic acids	2.3	1.7	2.4	2.6	8.1	7.9
Melanoidins	0	0	25.4	25.9	25.1	28.6
Ash (minerals)	3.9	4.4	4.5	4.7	8	7.4
	These data are expressed as "grams of the considered molecula in 100 grams of coffee powder"					

Fig. 1



The principal drug present in coffee based beverages is caffeine. Caffeine is a bitter, white crystalline xanthine alkaloid that acts as a stimulant drug and a reversible acetylcholinesterase inhibitor [7]. Caffeine inside coffee trees acts as a natural pesticide that paralyzes and kills certain insects feeding on the plants. In humans, this drug is a central nervous system stimulant useful to restore alertness. It is the world's most widely consumed psychoactive drug, but, despite this, it remains unregulated. The pharmacologic action is due to different mechanisms. Firstly, caffeine crosses the blood–brain barrier and acts as a non-selective antagonist of adenosine receptors. Considering that adenosine is involved in the control of the sleep-wake cycle, an antagonism on this action provokes sleep disruption.

Further, it is a competitive non-selective phosphodiesterase inhibitor. With this action, caffeine intensifies and prolongs the effects of epinephrine and epinephrine-like drugs such as amphetamine, methamphetamine, and methylphenidate. The result is an increase in the gastric acid secretion and in the rise of the activity of the "funny current", which directly increments heart rate. In addition, it causes addiction and withdrawal effects [8]. In fact, there is a rapid development of tolerance and this can produce significant physical and mental dependence [8].

Clinically, caffeine at low doses can reduce some health risks, for example it has a protective effect against some diseases, including certain types of cancer [9]. Evidence of a risk to pregnancy is equivocal, but some authorities have decided to limit the consumption for pregnant women to the equivalent of two cups of coffee per day or less[10].

Caffeine has diuretic properties if taken by people who are not used to it, but this effect disappears in long-term use. Caffeine is toxic at high doses.

Process of brewing

Coffee brewing consists of dissolving soluble flavours from the coffee grounds in water. Chemically, it is an aqueous extraction conducted using several methods that can be classified in four processes: decoction, infusion, gravitational percolation, and pressurized percolation. To obtain a standardised extraction process is difficult due to the fact that the solvation of the molecules epends on their solubility at different temperatures, which changes during the extraction. To counteract this factor, guidelines exist that indicate the characteristic of a "well-made" coffee [11].

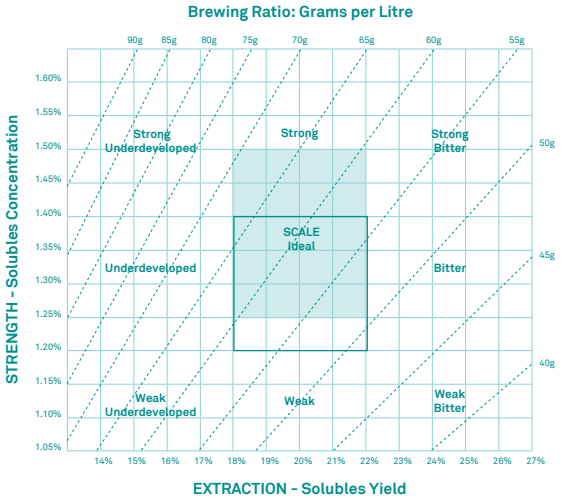
The elements that must be taken in consideration are:

- Soluble yield or extraction: indicates the percentage (by weight; with respect to the total of the powder) of the ground that is dissolved in the water.
- Soluble concentration or strength: indicates the percentage of the ground dissolved, which is extracted in the water solution.
- Brew ratio: indicates how much coffee powder must be used for a given quantity of water. Is possible to calculate this parameter through the relation:

Strength = Brew ratio × Extraction

The brewing guidelines are summarized in a "Brewing Control Chart", which graphs the elements of above. According to this diagram the values of extraction and strength must be centred around an "ideal" rectangle indicating the target brewing range. This measure varies between American, Norwegian or European standards. That reported is the chart of the European Community [12].

Table 2



Types of brewing: Espresso (using a Moka pot):

Is made through a process of pressurised percolation that uses hot water. The moka pot consists of three parts: a chamber, a metallic filter with a conic base that is close to the bottom of the coffee machine, and a pentagonal tank in which emerges the extract. The coffee powder is placed in the filter and is partially pressed. The chamber is filled with water and the filter fitted on its top to obtain a closed system. The tank is screwed on the head. When the pot is heated, the water boils into the chamber. In this way it is possible to get a bottom layer of hot water and a top layer of steam. This saturated steam with a pressure of above one bar (100 kpa, 14.5 psi), pushes the hot water that, due to the capillarity, reaches the filter provoking the extraction of the essence of the coffee. The extract will reach the pentagonal tank, thanks to the fact that the steam pressure is bigger than the external one [13]. The coffee ground used in this study to get the analytical data was Lavazza Suerte (medium roast; Arabica type).

Filter coffee:

Is made through a process of percolation that uses hot water at normal atmospheric pressure. The hot water is dripped onto coffee grounds held in a filter. The strength varies according to the ratio of water to coffee and the fineness of the grind, but is typically weaker than espresso, though the final product contains more caffeine. Data was collected using Douwe Egberts Coffee Filters Arabica (rich roast).

Instant coffee:

This type of coffee is derived from already-brewed coffee beans. The "instant coffee" is commercially prepared using the procedures of freeze-drying or spray drying, after which it can be rehydrated adding hot water.

It is possible to control the strength of the resulting product by adding a different quantity of powder to the water [14]. Don Jerez coffee (medium roast; Arabica type), is analysed in this research.

Distilled coffee:

The method of extraction introduced in this research project involves the use of two types of coffee ground. In fact, the demineralised water suspension distilled uses the powder utilised in the making of espresso and, separately, that utilised for the filter coffee. The apparatus is an Alembic copper distiller with a particular condenser called "mushroom head".

Fig. 2

This instrument consists of three parts: a boiler chamber, which is the part in contact with the heat source and where the mixture passes from the liquid phase to the vapour state; the condenser, which is at a lower temperature to permit the condensation of the vapour into the liquid phase; and the receiving flask, used to collect the distillate.

The peculiarity of this distiller is given by the condenser. Externally, this is a tank filled with cold water (or other refrigerants) equipped with a duct for the entry and one for the exit of the cooling liquid. Internally, there is a canal in which flows the distilled liquid that is then led into the flask. [15]

In general, the distillation is a method of separating the mixture based on the different volatilities of components in a boiling liquid solution or suspension. This operation cannot be defined as a chemical reaction, but it is appropriate to denote it as a physical separation process. In the separation, the liquid is heated to force components, which have different boiling points, into the gas phase.

The gas is then condensed back into liquid form and collected. Distillation can be used also to separate gases by liquefying components using changes in temperature and/or pressure. Variants of this process are the "fractional distillation" (when different volatile 'fractions' are collected as they are produced), the "destructive distillation" (when a material is heated so that it decomposes into compounds for collection) and the "multiple distillation" (when the process is repeated on the collected liquid to improve the purity of the product). Industrially, the distillation can be called continuous or discontinuous. If the material inside the boiler is loaded without stopping the process of distillation, is a continuous process. If the material present inside the boiler is downloaded once it is exhausted and, then, is loaded new material, the method is called discontinuous [16]. The process carried using the "head of mushroom" alembic is a simple, discontinuous distillation. The quantity of caffeine extracted from the coffee ground is linked with:

- The pressure of the water of infusion. Higher values of this factor increase the rate of extraction of caffeine.
  The reduced influence in this method is due to the fact that this process works at 1 atm.
- The granulometry of ground coffee and its pressing. The finer the particles size, the stronger is the resistance to the passage of the water (resulting in an increased time of contact of coffee with the solvent) and higher is the solubility of caffeine. The effect of pressing provides further impediment to the water flow. The distillation of the ground coffee decreases this aspect due to the fact that the boiler is loaded with a suspension of coffee in water. Consequently, the ground is not pressed.

As a result of these considerations, it is reasonably possible to predict the obtaining of a low-caffeine distillate.

Analytical data

An organic solvent that is non-polar is often used to extract caffeine from coffee. The most used in literature is methylene chloride (CH_2Cl_2).
The principle based on this choice is the "like dissolves like" one. In fact, when a non-polar liquid and the water (the solvent used to extract the coffee) come into contact, they form two layers.

The caffeine molecule is lipophilic so it will dissolve in the apolar stratum. The two layers are separated and, the non-polar one is evaporated leaving the residue of caffeine. This is verified by the monograph of caffeine in the European Pharmacopoeia (Ph. Eur.), which gives the procedure of recognising this alkaloid [17]. The steps of this strategy are:

- Lassaigne's test: this assay is aimed at detecting an organic compound, elements other than carbon, hydrogen and oxygen that are assumed to be present. In relation to caffeine, nitrogen must be included. In this test, the organic solid is fused with metallic sodium (at about twice of the weight of the substance analysed) to convert these elements into water soluble sodium salts. This reaction must be done carefully due to the fact that it is highly exothermic.
- Test the presence of the nitrogen adding 2 ml of freshly prepared ferrous sulphate solution in 2 ml of Lassaigne's (sodium) extract. A Prussian blue colour confirms the presence of this element in the compound.
- Reaction of the xanthine nucleus: this assay is needed in order to demonstrate that the solid is a xanthine alkaloid. The method consists of putting 5 mg of the compound in a crucible, 2 ml of HC13 M and 2 ml of H_2O_2 30% v/v. Heat up until the complete evaporation of the liquid. Add to the yellow residue 2 ml of NH_3 0.1 M. A cardinal red colour as a result of this addition indicates the presence of the xanthine nucleus.
- Take the melting point of the residue. In fact, this is a unique property of pure substances. Caffeine melts at 238 °C. If the material collected liquefies within a range of 235-239 °C and is positive to the tests of above, it is caffeine.

Technical procedure:

- Coffee Preparation; for all the types of brewing, the volume of the coffee extract is 140ml; this is obtained using 48 ml of coffee ground and 150 ml of demineralized water, to comply with the guidelines of the European "Brewing Control Charts".
- Addition of approximately two grams of sodium carbonate (Na_2CO_3) to the coffee solution. By saturating the aqueous phase with this salt, it is possible to obtain the phenomenon of salting-out, which has the effect of decreasing the solubility of organic compounds in the saturated aqueous phase, and decreasing the solubility of the organic and aqueous phases in each other. This last effect is particularly useful in breaking up emulsions.
- Swirl the mixture until all the sodium carbonate dissolves.
- Addition, into a separating funnel, of 50 ml of the above solution and 20 ml of Kerosene. This is a liquid formed from hydrocarbons (between 6 and 16 carbon atoms per molecule) obtained from the fractional distillation of petroleum in the range of temperature from 150 °C to 275 °C. The major constituents of Kerosene are n-dodecane, alkyl benzenes, naphthalene and its derivatives [18]. This is the apolar solvent used in this study. Kerosene has advantages, compared to methylene chloride, of a greater lipophilicity and better availability in the market. Further, it presents a high ebullition point (about 260 °C) that is suitable to apply a different method to separate caffeine from the lipophilic solvent.
- Vigorously swirl the mixture for 10 minutes.
- Allow the mixture to stand and separate into two layers; a lipophilic top stratum and an aqueous bottom layer.
- Separate the aqueous layer from the lipophilic one by draining the aqueous extract from the tap of the separating funnel. Then, pour the lipophilic extract containing caffeine in a crucible.
- Evaporation of the lipophilic solvent. This is obtained through a variation of the standard method. In fact, differently from the methylene chloride that has a boiling point of 36.9°C and leaves the crucible simply evaporating to the air, the removal of the kerosene needs the administration of heat. The procedure consists in heating the extract up to a temperature of 238°C (that is the melting point of caffeine). The caffeine, after reached the molten state, will be encrusted on the walls of the crucible as soon as the temperature decreases. At this point, it is possible to remove the solvent (that is, for the bigger part, in the liquid state due to the fact that its ebullition point is 260°C) using a filter paper sheet.
- Kerosene is a highly flammable liquid. Precautions are required in the handling of this solvent and a strict adherence to safety procedures. It is advisable to use of a method of heating that doesn't require the use of open flames (for example induction hob); to perform the reaction under a lab extract hood, and to use a porcelain crucible to get a better fire resistance. Further information is in the Health Protection Agency "Compendium of Chemical Hazards".[19]
- Re-heat the crucible to remove the last traces of Kerosene.
- Scrape the caffeine encrusted on the walls of the crucible using a spatula.
- Weigh the residue of caffeine (the sensitivityis ±1 mg)

Fig. 3

From the left to the right: "aqueous phase" of the extraction of espresso, filter coffee, instant coffee and distilled coffee

Fig. 4

Fragment of pure caffeine obtained using the above method

Data

Data obtained through this method of analysis are shown in Table 3.

Table 3

	Average content of caffeine				
	1st Extraction	2nd Extraction	3rd Extraction	4th Extraction	Average
Espresso	67 mg	50 mg	60 mg	65 mg	(67+50+60+65) / 4 = 60.5 mg
Filter coffee	50 mg	42 mg	52 mg	40 mg	(50+42+52+40) / 4 = 46 mg
Instant coffee	51 mg	64 mg	51 mg	59 mg	(51+64+51+59) / 4 = 56.25 mg

These data are calculated on a volume of 50 ml of coffee

For the instant coffee these vales are obtained using 4 g of powder

Information on the average content of caffeine, obtained from the literature, is summarized in Table 4.

Table 4

	Average content of caffeine	
		Proportion to 50 ml
Espresso	80 mg in 80 ml*	50 mg
Filter coffee	100 mg in 125 ml**	40 mg
Instant coffee	50 mg in 4 g ***	

* S. Papadopoulos (1993) Nutrition & Food Sciences 1, 28–33

** 2006 USDA Nutrition Database SR19

*** 2006 USDA Nutrition Database SR19; Values are indicated as mg of caffeine for g of instant coffee powder

Table 5 shows a statistical comparison among the values indicated above.

Table 5

	Literature data	Measured values	Standard error (se)
Espresso	50 mg in 50 ml of extract	60.5 mg in 50 ml of extract	3.8
Filter Coffee	40 mg in 50 ml of extract	46 mg in 50 ml of extract	2.9
Instant Coffee	50 mg in 4 g of powder	56.25 mg in 4 g of powder	3.2

$$se = \frac{ó}{\sqrt{n}}$$

where n = number of observations = 4;

$$ó = \sqrt{\frac{\sum(\bar{x} - x)^2}{n - 1}}$$

n - 1 = degrees of freedom = 3
x = is the value of each sample = the content of caffeine for each extraction (data in table 3)
x - bar = is the average of the sample set = the average content of caffeine (data in table 3)

The "Standard error" in Table 5 is useful to evaluate the accuracy of the method used. In fact, in the range of "Average value +/- 3*Standard error", to get a statistically valuable data, 99% of the values must be present[20]. Those found in literature are in this spectrum. This fact proves the veracity of the data, also what must be taken into consideration are the variations provoked by technical limitations of the method used and factors that can have an effect on the amount of caffeine such as strength of the brew, growing conditions, processing techniques, soil chemistry, type of plant and cultivation practices.[21]

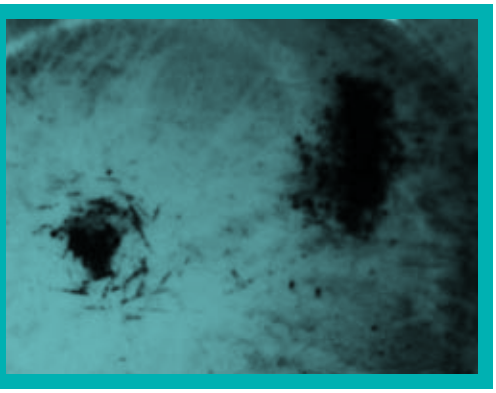
As a result, it is possible to expand the analysis on the measurement of the caffeine concentration of the distilled coffee. Data is displayed in Table 6.

Table 6

	Average content of caffeine in distilled coffee				
	1st Extraction	2nd Extraction	3rd Extraction	4th Extraction	Average
Distilled espresso	10 mg	11 mg	10 mg	12 mg	(10+11+10+12) / 4 = 10.75 mg
Distilled filter	30 mg	33 mg	32 mg	34 mg	(30+33+32+34) / 4 = 32.35 mg

These data are calculated on a volume of 300 ml of extract	
In 50 ml of extract	
Distilled espresso	(10.75*50) / 300 = 1.79 mg
Distilled filter	(32.35*50) / 300 = 5.39 mg

Fig. 5



Caffeine extracted from the "Distilled coffee" made with espresso powder (on the left) and filter coffee powder (on the right)

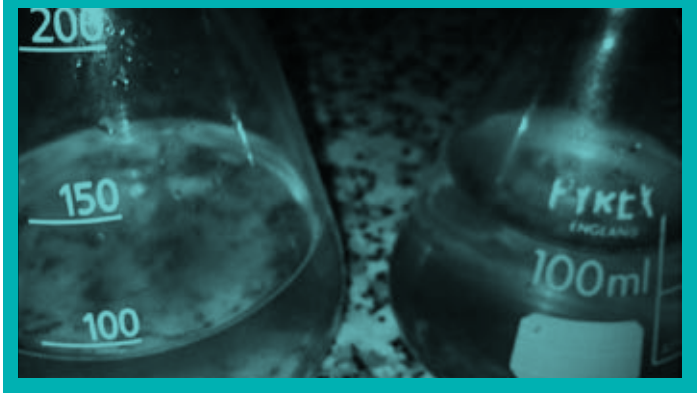
Results

Analysing the values of above, there can be seen a big difference in the presence of caffeine between distilled coffee and the others methods considered. This observation reflects the expectations. In fact, the divergence with the espresso is explained by the different pressure of the water of infusion. Instead, that with the filter coffee depends on the shortest contact time and on the smallest area of interaction of the water with the powder. Moreover, the concentration of caffeine in the distillate obtained from the ground used to make filter coffee is approximately three times that obtained from the powder of the espresso. This result may seem a paradox considering the fact that both the types of the extraction were made using the same brewing conditions and the ground of the espresso is finer than that of filter coffee. The explanation is in the torrefaction process sustained by the espresso ground which causes the loss of a part of the caffeine due to the thermal treatment.

Despite this discrepancy, both these extracts can be used in the preparation of beverages. In fact, according with the Food and Drug administration that regulates the caffeine content in sodas and colas, the acceptable limit is of 68 mgs per 12 oz [22] (about 355 ml), much bigger than that obtained with the distilled coffee, also considering potential measuring errors due to technical limitation.

The same considerations apply to the "Food Standard Agency" in the UK. Its guideline affirms that "The caffeine levels in energy drinks vary, but there's usually about 80 milligrams (mg) of caffeine in a small 250ml can. Some of the smaller shot style products can vary from about 80mg to as much as 175mg of caffeine in a 60ml bottle" [23]. This agency refers to the EU labelling rules which require that drinks containing more than 150mg of caffeine per litre (mg/l) are labelled with the term 'high caffeine content' in the same field of vision as the name of the food and accompanied by an indication of the amount of caffeine per 100ml in the product. [23] On the other hand, there exist voluntary industry labels such as that of the British Soft Drinks Association who have published a code of practice covering the promotion of high caffeine content drinks. The code of practice requires that all drinks with high caffeine content carry the additional labelling statement "Not suitable for children, pregnant women and persons sensitive to caffeine". In addition, such drinks may not be promoted or marketed to persons aged under 16 [24]. In contrast to all these regulations, many energy drinks, to avoid these rules, are legally classified as supplements. Supplements (vitamins and such) have a much lower oversight than food and drugs. Natural caffeine levels are also exempt from these regulations so coffee based drinks may have more caffeine than the limit without being classified as a supplement.

Fig.6



"Distilled coffee" obtained with the espresso ground (on the left) and filter coffee ground (on the right)

Conclusion

The determination of the fact that the distilled coffee can be considered as a low-caffeine content beverage, and that it complies with the directives on the concentration of this drug, justifies further technical studies aimed to enhance the flavour of the obtained drink, making it suitable for the market.

Obviously, food additives can be added to drinks only after extensive testing and authorization agreed with the European Food Safety Authority (EFSA) and that can last for several years. This research, then, is the first step of the long procedure of the marketing authorisation.

Author

Raffaele Conte, MIScT, is a graduate in Chemical and Pharmaceutical Technology from the University of Naples Federico II, and he is also a recognised scientist and a registered Pharmacist in Italy and in the UK (member of the GPhC). He has undertaken specialist training, at the undergraduate and post-graduate levels, in various areas of biological, chemical and pharmaceutical sciences. His passion for nature and research led him to become a member of the Cambridge Natural History Society and of The Research Cooperative. Raffaele is the author of several articles on different peer-review journals and, currently, he is working on the epigenetic regulations of gene expression at the National Research Council in Italy

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Dust-free physics

Stephanie Walton

I'm a Physicist, and when people ask me what I do on a day-to-day basis, I'm never quite sure what to say. Yes I sit in front of a computer screen some of the time, a bit like other people. Yes, I read articles, look things up on Wikipedia, and play around with a calculator a little. I even do the occasional experiment. But then I'm always stumped when I try to describe the "clean room". Because, a bit like a bad joke, I think you just have to be there to really understand it... However, forever the optimist, I'll see if I can convey some of what goes on in there for you.

First things first, the cleanroom is, as the name might suggest, a dust free environment; very important in complex sample preparation processes. There is no natural daylight and the substitute artificial light has some wavelengths removed such that you can't see yellow properly. Thankfully I've always preferred green so this doesn't bother me hugely. Scientists roam around in blue jump suits, blue boots, blue hats, safety goggles, a face mask and not one but two pairs of gloves. Well the first problem with the outfit is this; everyone looks the same.

Many a time have I tapped the wrong person on the back or addressed someone accidentally, and I often blank people I'm meant to be friends with.

The second problem is that if you accidentally forget something needed for the experiment or the solvent you require runs out, you have to endure an enormously tedious and laborious gowning and de-gowning process just to nip out the room for 30 seconds.

Well, supposing you do overcome the social awkwardness of the cleanroom and also remember everything that you need, the fun (sample preparation) can begin. The gloves, scalpels and tweezers combine to give you an inflated sense of importance; I always feel like a surgeon just about to operate. However, instead of having a human being to save, I wander around with a very fiddly 6mm by 6mm sample (much smaller than a finger nail) trying not to drop, break, scratch or even lose it; not quite as easy as it might sound. For instance, if the laminar flow benches are in a particularly aggressive mood and you tarry too close to them, you can't expect to see your sample ever again. Something else to be avoided is interfering with or accidentally stopping someone else's experiment; it's not the way to make friends, I assure you.

However, these experiences pale in comparison with the ultimate cleanroom activity; cleanroom duty. How does one clean a cleanroom you might ask? Thankfully there are rigorous instructions in case you go astray, with no fewer than 14 steps in total. Luckily you are paired with another user (some of whom take quite a back seat role in the whole duty) to join you in the vacuuming, swabbing, solvent replacing and glove replenishing tasks. There is actually quite an art to this. You should try to avoid cleaning away other people's experiments. You should certainly never jog someone with the hoover whilst they're pipetting. And you should exercise care when checking that the emergency eye bath is still operational; it invariably is, and as such, has the potential to create enormous puddles of water on the floor.

Having analysed some of the cleanroom's stranger aspects, I should probably touch on some of its strengths.

It is extraordinarily well equipped with useful things like solvents, sample boxes and a microscope, and there are more glass slides than you could ever want; it's the perfect place to prepare your samples. When you next find yourself needing to make a sample in a dust free environment and you get shown to a cleanroom, follow the advice above and you should have a trouble free visit. Oh, and one last thing, try not to sneeze.

We design and make our magnetic structures at Imperial College out of a material called Permalloy (which is an iron-nickel alloy). Typically, our magnetic bars are 1 micron long, 100nm wide and 20nm thick; this is tiny considering that the wavelength of visible light is 400-700nm.

My group is especially interested in looking at collections of these nanomagnetic bars on a honeycomb lattice. This is called

"2D artificial spin ice".

As you might imagine, trying to measure these tiny magnets' properties is hard, and magnetic simulation is a useful tool to help predict how the magnets will behave.

I work on experiment and simulation, the best of both worlds!

Stephanie Walton works in nanomagnetism in the Experimental Solid State Physics Group under the supervision of Dr. Will Branford at Imperial College.

Background Image: Courtesy Wikipedia Commons, Cardiff University, Stan Zurek

Editor's note:
Readers might be interested in this extract from the Global Society for Contamination Control (GSFCC) publication of "Appropriate Behaviour within Cleanrooms".

1. Silly behaviour should not be allowed. The generation of contamination is proportional to activity. A motionless person can generate about 100,000 particles @ 0.5 mm/min. A person with head, arms and body moving can generate about 1,000,000 particles @ 0.5 mm/min. A person who is walking can generate about 5,000,000 particles @ 0.5 mm/min. Personnel who move quickly past products may cause a disturbance of the air that leads to contamination.

There are a further 11 instructions in the guide.

Creative arts technicians

Technical service support for the creative arts in higher education institutions.

Kuldip Singh

Technical services in academic schools within higher education are responsible for the maintenance, development, and support of specialist facilities and IT resources. The skills required in enriching new technologies and focusing on degree programmes that are relevant for today's market place require investment/development and, crucially, recognition for technical staff in areas such as music, journalism, and arts based subject areas.

The use of technology for classroom support and the use of more specialised facilities have pushed the demand for more skilled staff. The development and delivery of workshops in creative digital disciplines now heavily rely on the technical skills of technicians. In supporting existing technical knowledge and skills it is important that any future skills and technology gaps are re-evaluated so as not to lose our focus on what higher education requires in line with what industry is demanding from our future graduates.

The current economic situation will effectively bring cuts for the creative arts in higher education funding. Resources are not going to be easily accessible. Therefore, future and current industry trends and the needs of the potential student employer will need to be better understood. The level of existing staff skills will need to be reviewed and assessed to ensure that we remain strong within our various fields of technical support to the arts.

For technicians to adequately support and meet the needs of academic requirements, in line with their university strategies, we will need to focus on an understanding of those specific technical support skills and techniques required; and to ensure that adequate training and development is planned and made available. Key performance indicators may need to be developed to help analyse and evaluate at both department and university level.

An important role of the technician is in ensuring that resources are adequately maintained and that the available technical skills are matched to the academic support for teaching and research.

Conceptual Model for research

Skill and knowledge development time must be made available to help technicians to research new products and develop services in-line with new technologies and methods of delivery.

The example above (right) provides a basic scope of links to my university's key performance indicators (looking at targets) and how this then links to my academic school. The school relies on the technical team to provide the necessary services to support academic, research, student and admin functions. There are therefore clear indicators that show technical competencies are required in those teams and those essential requirements for training and skills are evident to provide the ability to carry out essential services and improve on service levels.

The role of specialist staff within creative arts does vary and development and training support needs for these roles can be challenging to ensure they receive the right skills and competence to carry out their role in delivering teaching support. Rapid changes in technology and the demand in the use of facilities are growing and the spread of understanding required of different types of technology used within digital creative arts is very wide. There is a real need to also promote recognition of the value and professional standing alongside bespoke training and development for technicians within these fields.

Establishing an approach

Prioritising the development and support for training technicians, to help them deliver the right tools for carrying out their duties, will have a real impact towards helping an organisations realise its strategic aims and objectives. By linking this training outcome to the university's key performance indicators it would serve a clear purpose and also show the true impact of performing to the professional standards important to the success of the organisation.

In considering an approach to improving technical services established research indicates that we should consider introducing clear key performance indicators for technical staff to provide a focus in-order to achieve their goals and performance.

It is important to target the strategic focus; Recardo & Wade (2001) put the business strategy as the first path in developing the performance measure. Performance measurement links the organisation from the top level management to the staff on the shop floor and then linking this back to strategy; this is known as alignment management.

Katzenbach and Smith (1993) mentions that if the team's performance targets are not aligned with strategic purpose then the targets will not be clear and can confuse staff as they will operate in different patterns and will not meet clear and set performance levels.

"KPIs represent a set of measures focusing on those aspects of organisational performance that are the most critical for the current and future success of the organisation."
(Parmenter, 2010, p.4)

Measuring performance can be one method to meet our expectations in providing quality facilities and provide challenges to continue to build on high levels of student satisfaction and achievement by maximising our performance.

To focus on one area of key performance would be valuing and developing our technical staff

- To attract and retain high quality staff
- Support staff to achieve their best
- To promote equality of opportunity and diversity
- To develop leadership/management skills in a wide range of staff.

The technical manager

Reflecting on the above, areas of support from managers are to ensure that technical staff have the opportunities to engage in development.

- Ensure specialist training support is available
- Promotion of staff development process for continuous learning
- Conduct appraisals – link to skills and training
- Regular briefing to encourage best practice

Technical managers are responsible for ensuring that relevant training support and development is available for specialist technicians within their fields of work.

A typical example of the role of a specialist technician in my School of Music, Humanities and Media does encompass general duties that are needed to fulfil a wide range of support alongside the highly skilled specialist duties.

These would typically include:

1. To organise and manage the day-to-day operation of facilities, including operating a booking system for the facilities.
2. To undertake the setting up and installation of hardware and software facilities.
3. To liaise with the Technical Support Manager with regard to purchasing and commissioning of new facilities.
4. To identify the need for equipment maintenance and repair and make the necessary arrangements to ensure that facilities are maintained at a satisfactory operational standard.
5. To work as part of a team within the technical support team.
6. To take responsibility for the safe and effective use of equipment and to ensure that advice and assistance is given to users of the facilities to ensure they are used in a safe manner.
7. To assist the TSM to carry out health and safety duties as required by the university health & safety procedures and the school's health & safety policy document.
8. To assist with maintenance of the local asset register in accordance with University inventory procedures and to maintain relevant equipment security measures.
9. To attend any training as may be required to improve skills and knowledge.
10. To carry out any other occasional duties this may fall within reasonable scope of the post.

The role of specialist technicians would typically have extra duties that follow specific guidelines in order to provide a more technique and skills transfer role and student project assistance and advice.

11. To be responsible for demonstrating and advising staff and students in the use of equipment, systems and techniques in creative subject areas.
12. To develop support material under the direction of academic and technical staff.
13. To troubleshoot student-orientated problems in specialist applications, including in support of student project work.
14. To be responsible for demonstration of specialist subject area facilities.

Working in creative arts does require a number of different skills and a high level of competence to deliver academic teaching support. To profile an example of these attributes, I have a selected a media technician role, which gives an indication typical of the experience and skills required to deliver support in this field.

- Experience of technical support in a television studio
- Experience in the knowledge and use of Industry standard Television production cameras and editing suites
- Working knowledge of radio and print production equipment
- Ability to communicate effectively with a variety of users at different levels, using a wide variety of methods
- Ability to write coherent reports, user guides and teaching material
- To advise and demonstrate use of equipment, systems and techniques to small groups.

These typical skills and experience are very important to the quality of the service we provide. To sustain this level of support we need commensurate training and recognition of competence to be accredited to technicians in these fields.

My name is Julian Schofield and I am the Media Technician for the University of Huddersfield. My history has been in more corporate companies, as diverse as filming travel guides to broadcasting to bank branches every week.

My current role is to support, maintain, and develop the use of the media facilities for the School and support teaching and project work in these facilities. To also provide technical assistance as regards the commissioning, maintenance, setting up and demonstration of equipment used to support academic teaching. We do have a vast amount of broadcast facilities to cater for our Journalism degrees.

My daily routine starts with viewing the on-line booking system where students and staff can book out various location facilities for broadcast TV & radio, and also book space for studio and video editing.

The system helps me sort out my time for when I am available for supporting class sessions in the TV studio or for making myself available for demonstrating to students various broadcast facilities such as video cameras or handheld audio recording devices outside teaching sessions.

The interactions with the students are vital because the students have to get their heads around so much of the professional equipment that is used in the broadcast industry.

The TV studio itself has so many various roles like vision mixing, sound, graphics etc. The students will need to gain knowledge and experience in the use of those of facilities in-order to record news programmes and work as a production team which I work closely with them to achieve their goal.

I enjoy passing on important skills to students such as demonstrating techniques in video and audio editing and these skills provide the students with the right tools to help support their project work and assessment.

Julian Schofield (2012)

Julian Schofield, University of Huddersfield

My colleague Julian Schofield has kindly provided a brief look at the day in the life of a Media Technician within the creative arts field.

Conclusion

We must continue to be committed to developing the professional profile of our arts and media-based technicians, specialists and managerial staff. The information in this article provides some scope in the types of work involved in creating an understanding of specialist support within creative arts.

Author

Kuldip's career began as an audio-visual technician based at Dewsbury Further Education College in 1987, before he arrived at the University of Huddersfield 12 years ago. In that time, he has seen the role of the technician grow.
Subjects such as drama, music and media might make the heaviest technical demands, but all subjects within the School – such as English and History – draw increasingly upon the latest technology, such as tablet computers.
This means that Kuldip Singh and his team must keep well on top of all latest developments and integrate them into the University's system ... and make sure that they keep working.

Editor's note:

The arts contribution to UK economic recovery

The creative industries, identified by the Work Foundation as one of four sectors with greatest potential to support economic recovery, have a central role to play in our future economic success, and were recognised by the chancellor as, "a key part of the new economy we are seeking to build". This is one of the areas in which the UK can rightly claim to be world-leading.

Over a million people work in the UK's creative industries, with a further 800,000 employed in creative occupations in businesses outside the creative sector.

The sector accounts for more than seven per cent of UK GDP and has shown consistent, above-average growth for more than a decade. It is also proportionately larger than any creative sector in Europe (the creative industries account for 2.6 per cent of EU GDP4) and consistently punches above its weight in global markets.

Evidence also demonstrates the extent of higher education's engagement with the creative economy. All kinds of universities are involved, from the specialist institutions in creative and performing arts to multidisciplinary, research-intensive universities. Eighty-one per cent of the universities in England have identified the creative industries as a target sector for external engagement – the next highest was energy, identified by 36 per cent.

Technology and arts technicians

They practice a range of technical methods on a par with those that technicians use in STEM subject areas.

The technology might be different, but the skills are comparable.

Examples encompass: pattern cutting, kilns, ceramics equipment, soldering, welding, mechanical workshop machinery, printing, silk screen techniques, advanced photographic equipment, digital weaving, film making, CADCAM, analytical equipment and techniques: Installation, testing & calibration, maintenance scheduling and procedures, programme design, art action simulation and analysis.

This is applied to diagnostic decision making about the execution of work, the delivery of high standards of practice, supporting appropriate and specialist learning environments, delivering inductions, demonstrations & technical workshops where students learn about processes, techniques, use of equipment & machinery.

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IST professional registrations update

Michelle Jackson

The number of members taking advantage of the IST's registration scheme is growing fast. The IST became one of the Science Council's pilot licenced bodies earlier this year and we are now able to award Registered Scientist (RSci) and Registered Science Technician (RSciTech) status to their members who fulfil the criteria. Up until the end of November members were able to take advantage of a fast track to registration, gaining registration at the reduced cost of £25, and not surprisingly there was a rush of applications to meet the deadline.

Members who apply for registration have to be able to demonstrate their knowledge and experience to the required level and undertake Continuing Professional Development to achieve registration – full details can be found on the IST website *www.istonline.org.uk/professional-registration.*

The IST has also been very busy running a series of workshops in a number of different organisations, to introduce the scheme and help explain the application process. If there is sufficient interest in your organisation, and you are interested in a registration workshop please get in touch with the IST office *(office@istonline.org.uk).*

To get a flavour of the sort of people we have been registering you can visit our website to read a number of case studies *www.istonline.org.uk/professional-registration/case-studies.*

Clinnt Gouveia RSci, MRI & OEM Production and Test Manager at Varian Inc., explained why he decided to go for RSci.

"I chose to become registered because I believe it provides professional recognition for someone like me, who has significant experience working in a scientific and higher technical position. Professional status helps to differentiate you from your peers and of course, within the broader job market."

"We must promote the professional standing of technicians, raise their profile and encourage businesses to nurture our home grown talent if we are to ensure we have the skills we need to compete in the high-tech, high-skilled economy of the future."

- Skills Minister John Hayes

Ben Palmer RSci, Materials Characterisation Research Technician at University of Sheffield, explains what he sees as the benefits of registration.

"I believe the key benefits of joining the register are; accredited recognition of the wide range of skills and experience I have gained, a means to develop myself professionally in the future given the constant need to show on-going CPD, and improved job security in an increasingly uncertain market. There is also a benefit to the organisation in that the support provided by their technical staff will constantly improve as technicians on the register continue to develop themselves."

Melanie Hannah RSci, Chemistry Senior Research Technician at Sheffield University, explains what sort of CPD activity she undertakes.

"I have found that a lot of my regular work comes under the remit of CPD. I regularly research papers on the chemistry of the research group for writing protocols and designing experiments. I take advantage of free webinars from manufacturers to keep up to date with the latest technologies. I am always eager to learn new skills and when the opportunity presents itself in the department I am always willing to under go in house training. For more soft skills training I have made use of the panosphix courses through the Heated website. This type of online training suits me as I work part time and a lot of the more formal training offered by the University is at times that would be awkward for me to attend."

"Establishing a common framework of registration for technicians working across the stem sectors presents a unique opportunity to establish common quality standards for UK technicians and ensure the skills and knowledge learnt within technician pathways develop in line with employers' needs. Over time the registers will raise the status and profile of technicians and this, in turn, should drive improvements in technician training and support increased recruitment. This initiative, Therefore, has the potential to make a major contribution to solving what for many years has been a major problem."

- Lord David Sainsbury

University of Sheffield trainees

University of Sheffield professional technician trainee programme

Introduction

2012 has been an important time for higher education; institutions are facing increased pressure to demonstrate they can offer value for money and, with the increase in student fees and budget cuts, it is so important to get it right. The Faculty of Engineering at the University of Sheffield have already started to address the issues by training new technical staff to be multi-skilled professional technicians.
The Faculty of Engineering has five trainees at the moment, all working across each of the departments covering its seven engineering disciplines. The programme begins with all the trainees first completing a two week induction. This includes Health and Safety such as risk assessment and COSHH, and introductory workshops covering the four key skill areas. A typical example would be in an introduction to electronics where the trainees are taken through each of the steps in the process of designing and building a simple printed circuit board as part the induction.
A large part of their training will be their Continuing Professional Development (CPD). This is documented using a specialised software package which contains a work diary with reflection. Departmental progression forums are used to establish what the trainees are doing and how they feel they have progressed. Action Plans are included for planning their way forward and a list of any training course they have attended recorded.
Each department has a designated senior technician who oversees their training in that discipline. They report monthly to all the other senior technical Staff, together with the Technician Trainee Programme Manager, and a representative from Human Resources on what sort of work the trainee has been doing and if any further training courses need to be made available.

The Technician Trainee Programme has been developed by a team of technical staff from across the Faculty and is a programme specifically designed to develop multi-skilled technicians who will have the experience and fundamental skill competencies to cover the four key- skilled areas, Electronics, IT Support, Mechanical Workshop and departmental laboratories.

New trainees are introduced to each department for an initial period of three months working alongside technical staff and managed by a senior technician and also the Technician Trainee Programme Manager.

While in these departments each trainee is introduced to as many of the key skilled areas as possible and if they are unable to do this, arrangements will be made to resolve the issue by placing them into another department for a short period. The senior technician collates feedback from the technical staff working alongside the trainee and gives feedback to other senior technicians and the Technician Trainee Programme Manager on a monthly basis. During the period that the trainees work in the departments they are also required to take part in practical workshops covering the key skilled areas as a group or individual. This is usually followed by a short individual test.

After the trainee has completed three months in the department, a short assignment is required to be completed which describes details of their acquired knowledge and experience. The trainees are given access to a webfolio which consists of a skills diary that must be updated on a daily basis. It involves self-assessment through trainee progression with reflection and evidence, workshops, and short tests to help them gauge their progress. We also encourage the trainees to create individual action plans as a way of self-motivation and goal setting. These are also monitored by the senior technical staff and the Technician Trainee Programme Manager.

We are aware that the trainees might progress at different speeds, so monitoring each trainee is very important and if difficulties arise in particular skill areas, an individual tutor session is set up to bring them to an acceptable level. The trainees are given adequate time to fill out their skill diary each week, and also time for group meetings and individual discussions.

By the end of the 2 year training programme we expect the trainees to be able to demonstrate a sound understanding of the following points:

Electronics skills
By the end of the training programme the trainee will be able to:

- Recognise components and their use.
- Solder to a good standard.
- Recognise basic faults.
- Use basic electronic test equipment.
- Design simple PCB boards.
- Build up a good knowledge base identified through their diary.
- Identify the Health & Safety requirements associated with each type of work.

Work effectively under instruction as an individual or as part of a team.

Mechanical Workshop
By the end of the training programme the trainee will be able to:

- Provide short periods of cover in mechanical workshop basic tasks for teaching and research.
- Use a range of basic engineering hand tools.
- Use a range of basic engineering machine tools.
- Carry out basic welding, metalwork and metal bending to a good standard.
- Understand how the design software drawing packages work and be capable of working with them.
- Identify the Health & Safety requirements associated with each type of work.
- Participate and work as part of a technical team

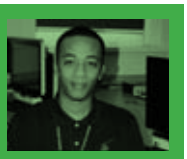
IT Support
By the end of the training programme the trainee will be able to:

- Provide short periods of cover in IT support for teaching and research.
- Liaise with CICs, register computers install managed systems.
- Understand the Web Content Management System.
- Install operating systems and software packages.
- Replace computer components and peripherals such as printers.
- Understand the relevant licensing regulations.
- Identify different programming languages.
- Build an extensive knowledgebase through their diary.
- Install and configure audio visual equipment.
- Keep good documented records and data.
- Obtain quotes and deal with orders and suppliers.
- Use the assets database.

Identify the Health & Safety requirements associated with each type of work.

Laboratory skills
By the end of the training programme the trainee will be able to:

- Provide basic laboratory support individually with more detailed support under supervision.
- Set up basic laboratory apparatus and equipment individually and more complex. Equipment/ apparatus under supervision.
- Generally maintain and clean equipment properly.
- Check and record equipment faults.
- Calibrate basic equipment individually and more complex equipment under supervision.
- Identify and handle a range of basic laboratory chemicals under instruction.
- Identify the H&S requirements associated with each type of work.
- Dispose of used laboratory chemicals and wastes safely.
- Understand Risk Assessments and COSHH.



Fahmi Mohammad, Faculty of Engineering Trainee Technician

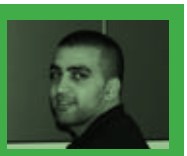
I lived and grew up in United Arab Emirates and came over to the UK back in 2001. I couldn't speak English very well as I'd never been taught the language, so I had to learn it quickly so that I could go on and finish my studies here. I went on and finished my GCSEs, and I remember at the time that I was fascinated by computers and I.T. in general and I knew then that I wanted my career to go in that direction.

I came from an I.T. background before starting University of Sheffield's Faculty of Engineering trainee programme having studied an AVCE I.C.T. course in college and went on to study a BSc Computing (Software Engineering) course at Sheffield Hallam University.

Having worked in the Faculty of Engineering before, as part of the Future Jobs Fund through an agency called CFFE (Centre for Full Employment), I had an idea of what to expect from the Trainee programme when I applied for it. I worked in the university for a period of six months and had had the chance to work in each of the seven departments of the faculty, and spent two weeks in each department.

It's been nearly six months since I started working in the University and I am enjoying it as I get to learn new skills that I would never have thought I would, such as TIG (Tungsten Inert Gas) welding, and the mechanical skills that I have learned can be useful in and outside of work.

If someone would have asked me 10 years ago where would I see myself in 10 years, I would not have imagined I would be working in the University of Sheffield as a Technician and gaining a wide range of new skills such as Electronics, Mechanical, Lab work and I.T. all in one and I am grateful for having such an opportunity.



Mohammed Khan, Faculty of Engineering Trainee Technician

I came from a business and IT background studying Business at college and ICT at University. I enjoyed computing - both the hardware and software sides - and decided this was the area I would like to continue my career in.

I experienced the typical scenario with the modern day graduate. With the economy not improving after graduating I was unemployed for over a year and then fell into a banking job which was just temporary. Whilst working here I continued to apply for IT roles and was continually unsuccessful. Losing heart I eventually got an interview for a temporary post at the University of Sheffield for an IT support job through an external training agency. I worked at the university for 6 months carrying out work in different departments but not really given a proper task to do, just the odd job as I was not directly employed by the university so there was only so much the technicians could give me.

After thoroughly enjoying my time at the university, being fascinated by the research and constantly increasing my knowledge in the Faculty of Engineering I knew I had to get back in!

I visited the University of Sheffield's website regularly for any vacant technical posts. After a few months of searching I saw the post for a Trainee Technician. The job description was exactly what I wanted so I applied and was successful!

As I worked here before I thought I had an idea of what to expect but I was wrong. I thought I would mainly be carrying out ICT related tasks.

Being 5 months into the programme I received a lot more than I had anticipated. The training and support I have received has been tremendous. I have covered work in IT, electronics, lab support and mechanical workshop support.

I feel like I am well on my way to being an all-round technician. I have been sent on a number of work related training courses, and have a lot of confidence in the people who are helping to run this trainee programme, who are collaborating with senior technicians across the faculty to make sure I get the right training and support.

Every day is different and this variety keeps me motivated - when travelling to work I have no idea what the day is going to bring!

Mark Jones, Faculty of Engineering Trainee Technician

Having come from an engineering family I suppose it was probably inevitable that my career path would end up being engineering related, having enjoyed nearly six months on the University of Sheffield faculty trainee program, it's an inevitability that I am extremely grateful for.

I grew up in Leicester and was almost constantly surrounded by engineering and all things technical. I soon developed the knack of dismantling things with consummate ease; the putting back together took rather longer to get the hang of. I progressed through school also helping my father with various car restorations and building projects, which broadened my mechanical knowledge. After completing A-levels in Electronics, Maths and Physics I began my Physics BSc at The University of Sheffield - I thoroughly enjoyed this experience, especially the time spent in a laboratory environment, and this hands on technical experience made me realise that I wanted to pursue a career as some kind of technician.

I completed my degree in 2011 and had gained vital experience in various experimental and theoretical techniques and well as knowledge of several programming languages.

After a six month period during which I worked for various voluntary organisations I found the position of Faculty Trainee Technician on the University of Sheffield jobs page.

This was an opportunity that immediately appealed to me, especially due to the experience in a variety of roles that would be gained during the program. I was lucky enough to be offered one of the five positions on the scheme and immediately accepted. I began the program by spending three months in Chemical and Biological Engineering. During my time in this department I constructed several electronic heater control boxes for research applications; I gained new skills in electronics and mechanical work during this process. I also had an active role in the IT support side of the department which involved tasks ranging from setting up PCs for new users to diagnosing and fixing hardware issues. Towards the end of my time in the department I spent significant time in laboratories and was trained on various pieces of analytical instrumentation. This was an area I particularly enjoyed and was lucky enough to recently have had the opportunity to cover for an absent member of staff for two weeks in this area.

I am currently working in the department of Civil and Structural Engineering. This department presents many different challenges as well as opportunities to develop existing skills. I am still thoroughly enjoying the training scheme and feel that I am gradually integrating with the university system, something that would not have been possible without the continued support and time of a great many senior technicians and especially program manager Geoff Howell.

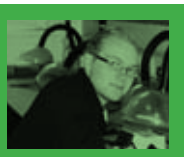
Peter Trend, Faculty of Engineering Trainee Technician

I started my traineeship in February, so I've been at the University of Sheffield for five months now. I have a mixed background - having worked in the banking and insurance sectors in the past and learnt project management, but my passion has always been for science and engineering. I have a Certificate of Higher Education in Audio Technology from the University of Salford, and the skills I learnt here in areas such as electronics and computer science have been very relevant to my trainee placement so far.

I spent my first three months of my traineeship in the Department of Civil and Structural Engineering. This was a very varied placement: I had the chance to work in teaching labs, where I helped academics to teach geology and soil engineering to undergraduate students; research labs, where I prepared soil and water samples, then learnt how to use the analysis instruments, such as gas chromatograph mass spectrometers. I completed some electronics repair and design work; spent two weeks working in the workshop - producing a set of acrylic flow cells which are currently being used in nuclear waste disposal research; and spent the remainder of my time strengthening my IT skills. As well as the daily diary I have kept, at the end of this placement I delivered a short presentation on my experience.

I then moved to the Department of Mechanical Engineering, where I have so far spent most of my time in their workshop and have been given a chance to learn a lot about metalworking and resistant materials technology. I have already been taught MIG (Metal Inert Gas) welding of mild steel, how to safely use the centre lathes and milling machines, as well as picking up how to program the CNC (Computer-Numeric Control) milling machine and CNC lathe.

This being engineering, there has been a great deal of problem solving which I found very enjoyable. Overall, I would say this must be one of the best training programs in the country for young people at the moment, with the focus squarely on teaching transferable skills in the areas of electronics, IT, mechanics, and laboratory work. Most of these skills will be useful regardless of the area we eventually specialise in. We are also very fortunate in that we have been sent on a number of training courses so far, including TIG (Tungsten Inert Gas) welding, and PAT (Portable Appliance Testing). All of the trainees are now qualified to complete portable appliance tests, and this brings additional legal responsibility over electrical safety and in spotting and dealing with dangerous appliances. We technical staff all have to look out for one other.



Jack Powell, Faculty of Engineering Trainee Technician

I studied my GCSEs in Sheffield before moving to Switzerland to work at the age of 17. I spent 18 months in Switzerland working in an international school and studying A-level French part time. In the job that I was doing I developed lots of skills such as mechanical and IT. I assisted the IT technician setting up audio visual equipment and upgrading hardware or software on the computers. I always enjoy working around computers and IT so working in the university is a fantastic opportunity for me to do that and develop my IT skills even more.

I did 2 weeks work experience in the university in the department of Electronics and Electrical Engineering which I really enjoyed. I helped in the IT workshop setting up new PCs or troubleshooting broken ones.

I had a keen interest in what I did and so I kept looking on the university website for jobs and could hardly believe it when I found this one!

When I started working in the university my strongest area was in IT. I have now learned many new skills such as electronics, TIG (Tungsten Inert Gas) welding, and have attended a few courses such as City and Guilds PAT Testing, manual handling and National Instruments LabView courses. Over the two year training scheme we spend three months in each department around the faculty, and for my first three months I worked in the department of material science. I really enjoyed working with the technicians there and experiencing what their day to day job is like. I am now working in the department of Automatic Control and Systems Engineering.

As we rotate between the various departments, we gain valuable experience in the different working methods. Each department may do the same type of job differently and it is fantastic to be able to learn all these different ways. We have met some fantastic senior technicians who have helped us progress so far. Our programme manager has given us the opportunity to go on training courses and achieve various qualifications.

I am really looking forward to working in the rest of the departments around the faculty and developing my skills in IT, electronics, mechanics and laboratory support.

Conclusion

In the year that the University of Sheffield Professional Technician Training Programme has been under development, significant progress has now been made to the on-going detail and structure of the programme.

Each of the first cohort of trainees enrolled in the scheme have already demonstrated significant professional development. In this short time, academic departments have progressively taken on a more participatory role, ensuring that the integration of the trainees has been relatively seamless into each respective department discipline.

The scheme itself has encouraged much deeper cross-departmental communication, which has been an important factor in order to organise the various placements. Several departments have already committed to employing both existing and future trainees on a permanent basis. This has been an integral part in ensuring the sustainability of the scheme in the long term.

A number of other universities have also shown a keen interest in the scheme, and some of our current trainees have delivered presentations to these universities to help explain the specifics of the UoS programme. We used this opportunity to further add to the breadth of our programme, giving trainees the "real life" experience to build and improve their presentational skills in a formal academic environment.

The trainee programme has received widespread praise from many quarters, not least the trainees themselves. Other faculties in our University are developing similar training programmes tailored to their specific needs. This aligns with the University's recently announced ambitions for professional recognition of technical staff, and as such is widely supported by the University as a whole.

The current Faculty of Engineering programme is in its infancy and still needs some refining, but its mid-term future is seemingly assured, with funding guaranteed for the next two years and the second intake of trainees having just been appointed.

Geoff Howell

Authors

This article was written jointly by the Faculty of Engineering trainee technicians:
Mark Jones
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Introduction and conclusion by Geoff Howell, Faculty Trainee Programme Manager.

From the archives

Pulvermacher's patent portable hydro-electric voltaic chain

Alan Gall, IST Archivist

The battery is born

Alessandro Giuseppe Antonio Anastasio Volta, after whom the volt is named, sent details of a sensational new invention to the Royal Society of London in 1800. It was the voltaic pile, a steady electrical source. No longer did researchers need to produce frictional electricity for their experiments – current now flowed from a simple construction of alternating zinc and silver discs separated by brine-impregnated cardboard. The new generator of electromotive force soon gave birth to further important discoveries, such as the separation of elements from their salts by the process of electrolysis.

Medical electrotherapy was another area that attracted serious research but also gave opportunities for the unscrupulous to take advantage of the general public's ignorance of the relatively new subject. The battery allowed this therapy to be provided in a portable form.

Pulvermacher arrives in London

A noted pioneer in the application of electricity for medical purposes was Golding Bird who lectured on the subject at Guy's Hospital, London. In 1851 he received a visit from one Isaac Pulvermacher, the consequence of which caused much subsequent aggravation. A letter written by Dr Bird explains the circumstances and results of the 1851 meeting.[1]

Isaac Lewis Pulvermacher[2] , described by Golding Bird as "a man of great scientific attainments", came calling with an introduction from a German physician resident in London. Said to have arrived from Vienna, and speaking very poor English, Pulvermacher presented a sample of his invention for evaluation– an adaptation of the voltaic pile. In this version, each individual cell consisted of a wooden rod concentrically wound with copper and zinc wires. These sat in groves that brought the wires close to each other without touching. Soaking the rods in an electrolyte, such as vinegar, activated the battery action and by connecting many rods in series the voltage could be increased to high levels.

The basic battery arrangement would later be developed into a wide range of appliances to fit various part of the body.

Charles Meinig takes charge

Golding Bird found the basic device useful for experimentation and shortly after wrote a paper for the medical journal The Lancet describing its virtues. Another visitor then arrived at the doctor's house: "...a person whose name I never knew, but who described himself as a friend of Pulvermacher's". This person may have been either Herman Immerwahr or Adolphe Rosembaum, known to have been Isaac Pulvermacher's business partners[3]. A further possibility is that the mystery man was Charles Ludovic Augustus Meinig although Meinig subsequently made reference to the caller as "my agent".[4]

Whatever the identity of the representative, he was able to persuade Dr Bird to write a testimonial with the objective of introducing the device to doctors in Edinburgh. Bird confessed in his letter: "I never before paid so heavy a penalty for giving a certificate to any one."

> ***We have in this ingenious Invention that which has long been a desideratum, viz. an Apparatus of the smallest possible bulk, capable of evolving a continuous uninterrupted current of Electricity of moderate tension, and always in one direction.***
>
> ***I can scarcely recommend Dr. Pulvermacher's Invention too strongly to my medical brethren.***
>
> ***(Golding Bird's endorsement as it appeared in the North Wales Chronicle, 18 June 1852.)***

Charles Meinig, representing the Pulvermacher enterprise, made good use of the doctor's endorsement. In a series of newspaper advertisements, including the medical press, he made the most preposterous claims – all backed up by the good doctor's testimonial. The authority of Golding Bird opened other doors and a whole raft of favourable

comments featured in the advertisements; one display in 1852 listed 34 doctors and scientists. The energetic Meinig set about establishing an extensive network of stockists and agents in various parts of the country and abroad.

Ferris and Score, a long established Bristol chemists, added "Dr Pulvermacher's" chain to their range of medical accessories shortly after Meinig began his expansion of outlets. The title "Dr" was no doubt introduced by Meinig to give credibility. The name of Ferris & Company became familiar to laboratories in the West Country as it went on to supply scientific apparatus and chemicals under BDH Ltd until the early 1980s. The company formulated a liquorish pastille called Nigroids that is still available today but under the name of Vigroids.[5]

The Association Medical Journal printed a letter from Meinig to Dr Golding Bird written on 1st December 1851 after the latter had complained about the misuse of the recommendation. Clearly, Meinig was intent on exploiting the situation to the full, ignoring threats of legal action, saying: "Anxious, therefore, as I am to oblige, I cannot withdraw the copy of your words from the advertisement, which I am sorry you consider of a puffing description.[6]

In the same year (1849) that Isaac Lewis Pulvermacher lodged a patent application covering "Galvanic-batteries, electric-telegraphs, electro-magnetic and magneto-electric machines", Meinig filed one for "Applying galvanism and magnetism to curative and sanatory purposes". This appears to have been initially a sideline for Meinig as the 1852 directory of London lists him as an importer and manufacturer of grindstones "from his own quarries". Indeed, Meinig received a medal at The Great Exhibition of 1851 for his "collection of grindstones, hones, etc." At the same exhibition he displayed Pulvermacher's chains, with a clockwork interrupter[7] for creating a discontinuous current from the batteries.

Development of the electrical belt

The following account of Isaac's early development of his galvanic cells and belt is based largely on what he wrote in Galvanic Electricity, a pamphlet of 1875.

Isaac worked in the Jewellery trade and achieved his scientific understanding by self-study and attending some lectures in the early 1840s given by Professor Hessler at the University of Prague. At this time, Isaac developed what he called "an electro-magnetic engine for producing motive power". In 1846 he moved to Vienna where he managed to interest professors Andreas von Ettingshausen and Von Baumgarten in his ideas. What seems to have turned his attention to the medical applications of electricity was a series of advertisements for a construction of zinc and copper called "Goldberger's Chain". It did not actually produce any electrical current and so Isaac set about developing one that would.

Although speaking little or no French, in 1850 he decided to settle in France. It is known that he lived (and/or worked) at the Rue de Venegian, Paris and later had a branch at 18 Rue Tavant, Paris. His lack of fluency in English resulted in an over reliance on his London agent, the previously mentioned Charles Meinig. It remains to be established if Isaac Pulvermacher approved of Meinig's methods of generating custom through wildly exaggerated claims, though it must be noted that the pair became partners in 1852. However, they soon fell out, with Isaac stating: "I was compelled to launch my first Electric Chain through a sole agent ... whose only idea, I subsequently discovered, was lucre ... His manoeuvres to despoil me of my patent rights in France and England resulted in a lawsuit ..."[8]

In May 1854 they brought an action against each other before the Tribunal of Commerce in Paris.[9] Neither was satisfied with the 50,000 French francs[10] awarded to Pulvermacher, Meinig for obvious reasons. On appeal to The Imperial Court, the penalty was increased to 250,000 francs, said to be worth a tidy £10,000, but never paid.

Before the date of the legal wrangling, Meinig had been advertising Meinig's Patent Portable Galvanic Electro Generator with his usual enthusiasm as "The latest discovery in electricity", and proclaiming: "...when worn on the Liver, has been found a never failing preventative of cholera, supplying the central and hepathic system with vital energy to resist and counteract all miasmatic influences."[11] How much of Meinig's Electro Generator was based on Pulvermacher's device is not known. He may even have been selling existing stocks of the Pulvermacher chain under his own name. Meinig continued to advertise until at least 1859, at which point there seems to be no further coverage in the newspapers.

Advertising, post-Meinig

With the departure of Charles Meinig the advertising blitz continued, still quoting Golding Bird as well as many other noted practitioners. Isaac later defended the heavy use of such means, remarking:

Considering the favour with which these inventions have been received by the highest scientific authorities amongst physicists and medical men in every country, it has been with many a matter of surprise as well as regret that I should still be compelled to have recourse to advertising, instead of receiving freely from medical practitioners that extended patronage which the inventions deserve.[12]

Isaac amassed a very large collection of favourable reports from medical and scientific men, including case notes sent to The Medical Times. The general impression is that a number of physicians genuinely believed that the belts offered a useful therapy. Unlikely as some of the claimed results seem, there must have been some perceived benefits.
The Pulvermacher Company did outlast most, if not all, of its competitors, surviving for close to a century.

Electricity v. Magnetism

Whilst the Pulvermacher Company promoted the health benefits of electricity, others sort to achieve the same aim with magnetism. Isaac was scornful of firms that offered portable magnetic medical devices and took exception to advertisements starting to appear in Christian World, a newspaper that he used himself. A promotional method employed by some suppliers consisted of writing letters to editors, as if from an independent source, saying how beneficial a particular product had proved to be. In the Christian World issue of 10 March 1871, "An Old Subscriber" of Stoke Newington wrote "... to call attention to another patented invention, somewhat similar in principle, purpose, and practical use, worthy, at least, of standing side by side with Pulvermacher's, but at present not so extensively known " The writer then went on to praise Darlow's Patent Magnetic Belts.

Darlow and Co produced a range of medical magnetic appliances under the trade name Skeuasma. These were recommended and used by John Smedley of Smedley's Hydropathic Institute at Matlock. However, one has to question the authority of a person who concocted a chillie paste (olive oil, spermaceti wax and chillies) for spinal complaints and "Rubbed behind the Ears for Deafness." [13]

Isaac sent a letter to the Christian World stating that the flexible magnetic material used by Darlow & Co, called Magnetine, failed to exhibit any magnetism whatsoever. "A small magnet (to be purchased for a penny in any toy-shop) at least attracts soft iron filings, while the pieces of India-rubber placed between the flannels of the Skeuasma do not ..."[14]

Darlow countered by claiming that the test was unscientific and should have been performed with a pocket compass which, as Isaac later pointed out, would also prove that an ordinary door key showed magnetism. Not one to miss an opportunity, Isaac could at least offer his Patent Safety Pin Fastener made of magnetised steel for those "who may have a strong craving for magnetic influences." [15]

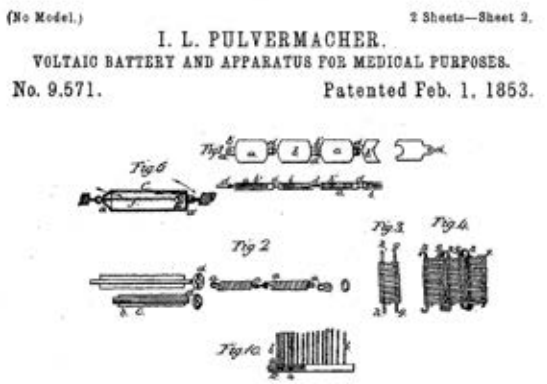
Rankin Kennedy tells the story of a trickster who set up in business, offering medical treatment with the aid of strong permanent magnets.

FRICTIONAL GLOVES
To promote circulation, thereby freeing obstructions by opening up the pores and assisting nature to throw off morbid matter which, if retained in the system, would lay the foundation of innumerable diseases. The magnetic power emanating from these gloves penetrates into every tissue of the body, arousing and equalising the vital forces, giving increased vigour and vitality.

(Advertisement for Skeuasma products in Ladies' Manual of Practical Hydropathy.)

After the man ran into "some trouble" the equipment went for sale and it was discovered that his magnets were merely painted pieces of wood. Yet many patients had claimed relief from serious medical conditions. Kennedy goes on to add that although a

normal magnet has no effect on the body, a rapidly alternating current in a solenoid will produce a magnetic field that will, and "What the medical effects are an electrician cannot presume to say."[16]


(No Model.) 2 Sheets—Sheet 2.

I. L. PULVERMACHER.

VOLTAIC BATTERY AND APPARATUS FOR MEDICAL PURPOSES.

No. 9,571. Patented Feb. 1, 1853.

Drawings from Pulvermacher's US patent showing the connection of individual cells made from wire-wound wooden rods. Figure 6 shows a body-movement-actuated current interrupter.

Advertising in later years

The Pulvermacher Company went in for a variety of newspaper and magazine advertising techniques over the years. Apart from the usual format, describing the products in glowing terms and claiming highly unlikely cures for some ailments, there was the less direct approach, suitable for products already well known to the public.

In one, a story is told of a policeman who spots a gentleman behaving oddly. It turns out that the man has been given a black eye in an altercation and the policeman is sympathetic, taking him to a place where the wound is treated. After about five minutes all trace of the injury has vanished and the last few lines reveal that the miracle curing-agent is none other than Pulvermacher's Galvanic Chain Band. Another example is an advert in the form of a poem (see box below).

Defeat he'd never felt
To disappoint his backers
Because he wore a belt
Of Mr. Pulvermacher's;
Invigorating, neat,
No clumsy, useless lumber –
They're sold in Regent Street,
One Ninety-Four's the number.

The last verse of a poem entitled "The Champion", about Jim Baker, a reluctant boxer. (Judy, 2 Sept 1896.)

An early promoter of "healing by electricity" was the Reverend John Wesley whose book, The Desideratum: Or Electricity Made Plain and Useful by a Lover of Mankind and of Common Sense, became available in 1760. When a re-printed edition appeared in 1871, Isaac took the opportunity to have a nine-page promotion included at the back. In a paper by H. Newton Malony,[17] the author seems to believe that the advertisement was in a 1781 edition. This despite his mentioning that the endorsement carries the names of four physicians to the Queen when, in fact, the monarch for the period (1760-1820) was King George III.

Pulvermacher's batteries in action

The electrical engineer Rankin Kennedy condemned the trade in medical electric belts.[18]

Not many years ago a business in "electrical belts" was carried on in London, the proprietors of which admitted that it yielded a "princely income." The male patients were fitted with belts worth about five shillings, but sold at five guineas. Females were fitted with corsets. An examination of the apparatus by any electrician proved that their powers of electrical generation were nil.[19]

As Golding Bird originally testified, Pulvermacher's chain batteries did produce a useable supply of electric current. The device was successfully demonstrated at a meeting of the British Association in Ipswich on 3 July 1851[20] and shortly before at a "soirée" organised by the Royal College of Surgeons. [21]

Charles Radcliffe, a physician and expert on epilepsy, studied the muscular movements resulting from the application of electric current and wrote: "...it is also a fact that a stronger current – the current for example of a Pulvermacher's chain of ordinary length moistened with vinegar – will produce contraction ..."[22] There were also non-medical applications as in Joseph Lovering's work on telegraph cables: "The batteries used in all the experiments consisted of 630 elements, of which 140 were those known as couronne de tasses, and 490 were those of Pulvermacher."[23]

In Isaac's patent of 1849 he packs in a number of inventions, making fourteen claims to novel ideas. The last one relates to electric telegraphs in which he describes a system of electro-magnets and "the substitution of a letter cylinder for the letter wheel

ordinarily employed". This, a rotary engine and other electro-mechanical devices represent an area that assumed a secondary interest as he concentrated more and more on the medical applications.

Isaac went on to study the problem of polarisation in batteries. This effect is caused when hydrogen collects on the anode, resulting in an increase in the internal resistance of the cell which in turn leads to a drop in both voltage and current output. In the Leclanche cell, for example, reacting the hydrogen with manganese dioxide prevents this accumulation. Isaac's solution was to expose the anode to atmospheric oxygen.

Pulvermacher's products reached the Antipodes, as did those of Charles Meinig whose one time manager of the London office, a Mr Sutherland, set up shop in Adelaide.[24]

A famous customer

On the 8 June 1870, Charles Dickens sent a cheque to Pulvermacher & Co after receiving a voltaic chain. He suffered from occasional bouts of pain in his right foot that he put down to walking in deep snow. A Mrs Bancroft had recommended the chain from personal experience of a similar affliction, and the relief obtained. Dickens wrote with his order on the 3 June saying he would send a cheque by return and promised to give the device "a fair trial".[25] This was not to be, he died on 9 June 1870. The letters were sent to Sothebys for auctioning on 14 February 1929. One sold for £78 and the other was withdrawn. The very last letter sent by Dickens fetched £480.[26]

The Pulvermacher family

Going by one report of Isaac's death[27] and census returns of 1861 and 1871, he was born in or close to the year 1815. He married Rachel Aaron Joseph in London on 30 November 1859, at a branch of the Great Synagogue on Portland Street. Such was their standing in the Jewish community that the couple were married by Nathan Adler, the Chief Rabbi for the United Kingdom.

After Rachel's death, he remarried to Augusta Fiedler in 1875 and they had three sons Marcus, Theodore and Oscar, and daughter Lena. Augusta remarried after Isaac died in 1884, to Noah Mitchell from New York. Isaac's money is said to have passed to Augusta's husband and Oscar, under the new regime, left school and worked as a delivery boy.

He then joined the Daily Mail as a messenger boy but rose in the ranks to become editor (1929-30) and a director. Marcus, who studied electrical engineering, ran the Pulvermacher enterprise, it is believed.

Finally

I. L. Pulvermacher & Co became incorporated in about 1896. It operated from 194 Regent Street but by 1905 had moved to 56 Ludgate Hill. Sometime around 1932 a factory at 113 Central Street, London E.C.1 commenced production. The company ceased to be listed in phone books from1943 and was officially dissolved in 1951 (exactly one hundred years after the appearance of Isaac Pulvermacher on Golding Bird's doorstep).

It is tempting to brand Isaac Pulvermacher as a charlatan on the basis of the extravagant claims he made for the curative properties of electricity. Yet he managed to impress many people with his devices and obtain testimonials even if he sometimes quoted then out of context. Patents and publications show he had a command of electrical theory and an inventive nature, whereas many of his competitors lacked even a basic understanding.

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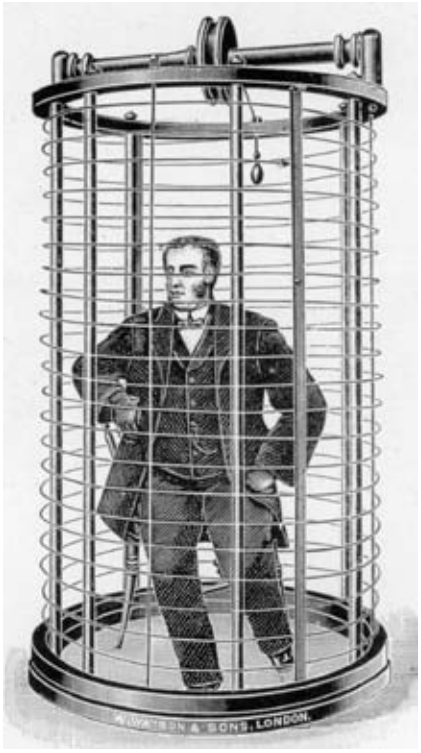
References to newspaper reports and advertisements are given in the text and endnotes.

Acknowledgements

My thanks to:
Jessica Leschnikoff for information on Isaac Pulvermacher, her great great grandfather.
Maurice Mishkel of the Australian Postal History Society for the image of an envelope addressed to Pulvermacher's Galvanic Establishment.
I would also like to thank the efficient and extremely rapid service for patent copies provided by Nicola Avella and colleagues at the Central Library, Sheffield.
SDA Electronics Ltd, Salford sponsored the research costs.



A medical solenoid. A rapidly alternating current, such as that from a Tesla high-frequency apparatus, generated the magnetic field. (Rankin Kennedy, p.201.)

GALVANIC ELECTRICITY;

ITS

PRE-EMINENT POWER AND EFFECTS

IN

PRESERVING AND RESTORING HEALTH

MADE

PLAIN AND USEFUL.

BY J. L. PULVERMACHER.

LONDON:

GALVANIC ESTABLISHMENT, 194 REGENT STREET.

(Opposite Conduit Street.)

1875.

Title page of the 1875 publication by Isaac Pulvermacher.

FERRIS & SCORE,

(BY SPECIAL APPOINTMENT)

CHEMISTS & DRUGGISTS TO THE QUEEN,

And Members of the Pharmaceutical Society of Great Britain.

NOS. 4 AND 5, UNION STREET,

BRISTOL,

Respectfully express their thanks to their Friends and the Public, soliciting the continuance of their esteemed preference, with the assurance that their *personal attention* will be unremittingly paid to the execution of their orders, as well as to the dispensing of Medicines, which occupies a distinct department, and is conducted with the greatest care and system, under their superintendence. All Prescriptions and Family Recipes dispensed by them are copied and referenced.

F. and S. beg to inform those Friends who reside in the neighbourhood of Bristol, South Wales, and the adjoining counties, who wish to be supplied with their own preparations, that any post orders entrusted to their care, shall have their best attention, and be forwarded together with any other parcels that, for convenience, may be directed to their house for enclosure.

Importers of Eau de Cologne, direct from Jean Maria Farina; Rose Water; Orange Flower Water; the French Essences; Arrow-Root; Tamarinds; Vermicelli and Maccaroni.

PURE COD LIVER OIL,

IMPORTED DIRECT FROM NEWFOUNDLAND.

MANUFACTURERS OF

FRY'S CONCENTRATED DECOCTION OF SARSAPARILLA.

Copeland's celebrated LAVENDER WATER, also his PRESTON SALTS, in bottles 1s. each.

Agents for SIR JAMES MURRAY'S and DINNEFORD'S FLUID MAGNESIA.

MR. JEFFRIES'S RESPIRATORS. HORSE HAIR RENOVATORS. SCHWEPPE'S SODA WATER, LEMONADE, MAGNESIA, AND POTASS WATERS.

The PATENT VULCANIZED INDIAN RUBBER AIR AND WATER CUSHIONS of every variety, from 18 inches square to 6 feet by 4. Also for Dr. PULVERMACHER'S PATENT AYDRO-ELECTRO CHAIN, so highly approved of by all the leading medical men of the day, for relieving RHEUMATIC AFFECTIONS, &c.

CHLORIDES of LIME and SODA,

For removing unpleasant effluvia, purifying the appartments of the sick, and preventing infection.

Advertisement from Scammell & Co's directory of 1852.

PRICE LIST OF MR. PULVERMACHER'S CHAINS, BANDS, ETC.

A. Narrow CHAIN-BANDS for Sciatica, Rheumatic, Neuralgic, and Gouty pains, Chronic rheumatism, Local paralysis, Cramp in the Extremities, according to Electric power...18s., 22s., 40s., and upwards.

B. Broad CHAIN-BANDS or BELTS for Lumbago, Indigestion, Liver, Chest, and Nervous Complaints, &c., wearable as a Belt.....22s. to 40s. and 55s.

C. Broad CHAINS and BANDS for Nervous Deafness, Head, Tooth, and Face Ache, and Noises in the Head .....21s. and upwards.

D. Broad CHAIN-BANDS for loss of Voice and other affections of the Throat, Asthma, Spinal Complaints, 10s. 6d., 18s., 22s., 30s., and 40s.

E. Broad CHAIN-BANDS for Writers' Cramp, Trembling, Nervousness, &c.....22s. to 30s., 40s., and 60s.

F. COMBINED BANDS for General Debility, Central Paralysis, Epilepsy, and Functional Disorders 40s. to 60s. Complete set, with Volta Electric Belt for restoring vital power, £5, or with flexible Chain Battery £8

G. CHAIN BATTERIES for Extreme Nervous Debility, Paralysis, and for restoring Exhausted Vital Energy (to be used in conjunction with specially combined Bands) .....£3 10s. to 4 guineas.

H. HIGH TENSION BATTERIES, with a complete set of Combined Bands, Belts, and accessories (for special cases) .....£10 and upwards.

I. INTENSITY BATTERIES for treatment by Electric Baths in the Patient's own bed-room in various cases, and for eliminating poisonous substances from the system (lead and mercury), Paralysis, Want of Power, &c. 60 elem., £3 3s.; 120 elem., £6 6s.

J. L. PULVERMACHER, 168 REGENT STREET, OPPOSITE NEW BURLINGTON STREET, LONDON, W.

A price list from the 1871 edition of The Desideratum.

MAGNETINE.

THE NEWLY-IMPROVED PATENT MAGNETIC

SKEUASMA

APPLIANCES,

For the Cure of Spinal and Liver Complaints, Paralysis, Bronchitis, and the various forms of Nervous and Rheumatic Affections, also for the prevention of Sea-Sickness, Cholera, Small-Pox, and Fever.

Messrs. DARLOW & CO. have much pleasure in calling attention to their newly-patented and greatly-improved Magnetic Appliances.

Some five years since, after patient and laborious scientific investigation into the powers of magnetism, it was the good fortune of Messrs. Darlow and Co. to elaborate an invention which has proved of incalculable benefit for curative purposes, as have been testified by hundreds of persons in all classes of society, who availed themselves of it when all other means had failed.

Notwithstanding the success of the original Skeuasma, Messrs. Darlow and Co. have ever been aware of the vast field for improvement which was open to them, and it has been their constant endeavour to perfect, as far as possible, the work they had taken in hand. One great disadvantage in the old patented article was its COMPARATIVE weight and substance, especially for summer wear; happily this difficulty has been entirely overcome in the newly-patented article, MAGNETINE, so that Messrs. Darlow and Co. are enabled to submit for the approval of the public appliances which are as far superior to the original Skeuasma as was that invention to the old system of GALVANISM, with its painful shocks, acid solutions, corroded metals, and other characteristics so objectionable to persons of delicate health and nervous temperament.

The great distinctive features of MAGNETINE are its extreme lightness and perfectly elastic character, combined with a greater magnetic influence, and thus a greater curative power, but without any additional cost. It is manufactured in various forms, in one case consisting of thousands of infinitesimal polar magnets of AS UNCHANGEABLE PERMANENCE as the natural loadstone itself, and in others of as equally permanent but far more delicate character.

DARLOW & CO.,

INVENTORS,

63, NORTH WOOLWICH ROAD, LONDON, E.

ILLUSTRATED PAMPHLETS POST FREE ON APPLICATION.

Advertisement from Ladies Manual of Practical Hydropathy (1872).

Pulvermacher's chain used in conjunction with a footbath. (From a pamphlet by J.Steinert, agent for the USA.)

The benefits of the Pulvermacher belt as shown in The Penny Illustrated Paper of 1903.

Notes

[1] "Dr. Golding Bird and Pulvermacher's Electric Chain", Association Medical Journal, (15 April 1853), 316-317.

[2] In Pulvermacher's patent, number 13933 of 1852, the spelling of his first name is "Isac". "Lewis" also appears as "Louis" in some references and he is referred to as "Isaac Lavis Pulvermacher, known as Isaac Leopold Pulvermacher" in The London Gazette, 25 January 1861. For many years, in business and in private, he used the initials "J.L."

[3] The partnership between Pulvermacher, Immerwahr and Rosenbaum was dissolved in 1858 as reported in The London Gazette, 29 October 1858.

[4] Letter, Charles Meinig to Golding Bird dated 1 December 1851, in "Dr. Golding Bird and Pulvermacher's Electric Chain", p. 317.

[5] Vigroids is made by Ernest Jackson, now part of the Kraft Foods Group.

[6] "Dr. Golding Bird and Pulvermacher's Electric Chain", p. 317.

[7] A "make and break" apparatus described in patent 13933 of 1852.

[8] J. L. Pulvermacher, Galvanic Electricity; Its Pre-Eminent Power and Effects in Preserving and Restoring Health Made Plain and Useful, (London: Galvanic Establishment, 1875), 73.

[9] The Morning Chronicle, 20 January 1855.

[10] Some reports give the figure as 200,000 francs.

[11] For example, in Berrow's Worcester Journal, 25 February 1854.

[12] J. L. Pulvermacher, p. 77.

[13] Advertisement in the rear section of Mrs Smedley, Ladies Manual of Practical Hydropathy, (London: James Blackwood & Co, 1872).

[14] Letter dated 23 May 1871, Pulvermacher to the editor of The Christian World in J. L. Pulvermacher, p. 96.

[15] J. L. Pulvermacher, p.102.

[16] Rankin Kennedy, The Book of Electrical Installations Volume III, (London: Caxton Publishing, c.1915), pp. 200-201.

[17] H. Newton Malony, "John Wesley and the Eighteenth Century Therapeutic Uses of Electricity", Perspectives on Science and Christian Faith, 45 (December 1995), http://www.asa3.org/ASA/PSCF/1995/PSCF12-95Malony.html, accessed 09 December 2012. [18] Kennedy was probably not targeting the Pulvermacher Company. A particularly notorious supplier of chains, The Medical Battery Company run by Cornelius Harness, featured in the press around the 1890s for its misdeeds.

[19] Rankin Kennedy, p. 199.

[20] The Ipswich Journal 12 July 1851.

[21] Daily News, 3 July 1851.

[22] Charles Bland Radcliffe, "An Inquiry into the Muscular Movements Resulting from the Action of a Galvanic Current upon Nerve", Proceedings of the Royal Society of London, 10 (1859), p. 349.

[23] Joseph Lovering, "On the Determination of Transatlantic Longititudes by Means of the Telegraphic Cables", Memoirs of the American Academy of Arts and Sciences, 9/2 (1873), p. 475.

[24] South Australian Register, 14 November 1853.

[25] Jenny Hartley (ed), The Selected Letters of Charles Dickens, (Oxford: Oxford University Press, 2012), p. 437.

[26] "£480 For Dickens's Last Letter", The Manchester Guardian, 15 February 1929.

[27] The Morning Post, 15 September 1884

Research news

3D Printing in Ceramics

A new AHRC film looks at how creative innovation can translate to new products. Arts and humanities research generates innovative ideas with real-world applications and commercial potential. One example of research that is realising this potential and contributing to economic growth is an AHRC-funded Knowledge Exchange project at the University of the West of England.

In this film we see how researchers at the Centre for Fine Print Research, Led by Professor Stephen Hoskins and his team, have developed new methods of creating ceramics using 3D printing technology and worked with Denby Potteries to test designs and develop prototype models in ceramics.

Through this method, ceramics are built up layer-by-layer using a specially created – and now patented - ceramic powder. They are then fired and glazed in the usual way. 'Printing' ceramics in this way means that highly intricate and complex ceramics can be created that would have been impossible to achieve using traditional methods. This has opened up commercial potential through quicker manufacturing processes and new design options.

Gary Hawley, Senior Designer at Denby, praised the partnership between his company and researchers, saying that the new process is "pushing the boundaries of what is possible".

The film concludes with Professor Hoskins' inspirational view of what the future for 3D print technology might look like. This includes the announcement of an exciting new AHRC-award of over £385,000, which will see Professor Hoskins and his team undertaking a major investigation into a self-glazing 3D printed ceramic, inspired by ancient Egyptian Faience ceramic techniques.

The process they aim to develop would enable ceramic artists, designers and craftspeople to print 3D objects in a ceramic material that can be glazed and vitrified in one firing.

Faience was first used in the 5th Millennium BC and was the first glazed ceramic material invented by man.

Faience was not made from clay (but instead composed of quartz and alkali fluxes) and is distinct from Italian Faience or Majolica, glazed earthenware.

"It is fascinating to think that some of these ancient processes, in fact the very first glazed ceramics every created by humans, could have relevance to the advanced printing technology of today. We hope to create a self-glazing 3D printed ceramic, which only requires one firing from conception to completion rather than the usual two. This would be a radical step-forward in the development of 3D printing technologies. As part of the project we will undertake case studies of craft, design and fine art practitioners to contribute to the project, so that our work reflects the knowledge and understanding of artists and reflects the way in which artists work."

- Professor Hoskins

This three-year research project will bring ancient tradition into the 21st century, bringing old and new together hand-in-hand by investigating three methods of glazing used by the ancient Egyptians: 'application glazing', similar to modern glazing methods; 'efflorescent glazing' which uses water-soluble salts; and 'cementation glazing', a technique where the object is buried in a glazing powder in a protective casing, then fired. These techniques will be used as a basis for developing contemporary printable alternatives.

Research news

£60 million boost for science innovation

On 15th November 2012 Business Secretary Vince Cable announced a £60m investment in UK universities to help our most pioneering scientists and engineers create successful businesses from their research, improve industrial collaboration and foster greater entrepreneurship.

The announcement was made, during Global Entrepreneurship Week, at a visit to the London studios of university spin-out company Space Syntax, an SME which uses advanced urban modelling techniques to design better cities and public spaces such as the redevelopment of Trafalgar Square in London and the replanning of Jeddah in Saudi Arabia. The funding comes from the Engineering and Physical Sciences Research Council (EPSRC), the UK's main funding agency for scientific research. They will award 'Impact Acceleration Accounts' ranging from £600,000 to £6m to 31 universities across the UK.

It will help support universities' best scientists and engineers to deliver greater collaboration with industry, bridge the gap between the lab and the marketplace and help them become better entrepreneurs.

The Business Secretary said:

"The UK's scientists are some of the most innovative and creative people in the world, but they need support to take their best ideas through to market. This could be by establishing a successful, technology-driven SME like Space Syntax, which I visited today."

"This investment I'm announcing today will help our leading universities become centres of innovation and entrepreneurship, generating commercial success to fuel growth."

The funding will support the very early stage of turning research outputs into a commercial proposition – the 'Valley of death' between a research idea and developing it to a stage where a company or venture capitalist might be interested. It will also allow universities to fund secondments for scientists and engineers to spend time in a business environment: improving their knowledge and skills and returning to the lab with a better understanding of the way companies operate and the challenges they face.

EPSRC chief executive Professor Dave Delpy said:

"The research we support is recognised as outstanding on the international stage. These awards aim to make a step change in the impact that has on society: generating new business opportunities which drive economic growth, creating better, more informed, public policy."

They will help companies to engage with research projects at an earlier stage and benefit from research breakthroughs and the fundamental knowledge they generate. The funding will be used to support partnerships with SMEs and larger companies and take some of the risk out of their investment.

Some of the university impact acceleration projects will include:

Entrepreneurs in Residence

Queen's University Belfast: Visiting entrepreneurs can come from diverse fields and will have already successfully delivered societal or economic impact from a research-related knowledge/skills base. Teaming up experienced entrepreneurs with research teams early, will allow researchers to accelerate the time between the discovery of knowledge and identifying a market opportunity.

Supporting London's Tech City

Tech City is the growing technology hub based around Shoreditch in East London, consisting of over 3,200 firms and its on-going development is a national public policy objective. UCL will use its Account to develop a unique service helping innovative digital London SMEs to test their new products and services, gain customer feedback and ensure its technical feasibility, by offering access to UCL as the world's largest "living-lab" for digital and media content.

Public Policy Hub

Engagement between university research and public policy remains a significant challenge for both academics and policymakers, despite the importance of ensuring that the development of public policy is informed by robust evidence. UCL are creating a public policy hub to enhance the impact of research on public policy. It will include a Centre for Engineering Policy, Transport Policy and Practice Initiative, and a Green Economy Policy Commission.

Impact Secondments

Through its Impact Secondments, the University of Southampton will directly support SMEs like Covesion, an innovative photonics manufacturing company, based in Hampshire, which successfully spun out of research from the University's Optoelectronics Research Centre. The Southampton Impact Secondment will provide Covesion with access to facilities and intellectual expertise brought directly into the company to quickly bring it's ground-breaking laser crystal technology to new global markets

Research news

Atlantic Ocean blamed for run of dismal UK summers

This year's dismal UK summer could be part of a run of poor summers caused by a major warming of the North Atlantic Ocean that occurred back in the 1990s.

According to new research published in Nature Geoscience, the North Atlantic warming in the 1990s coincided with a shift to wetter summers in the UK and northern Europe and hotter, drier summers around the Mediterranean. The patterns identified match those experienced this summer (2012), when the UK had the wettest summer in 100 years, while the Mediterranean suffered with temperatures as high as 40 degrees centigrade or more. The temperature of the North Atlantic swings slowly between warmer and cooler conditions, and the present warm phase has a similar pattern to warm conditions that persisted throughout the 1930s, 40s and 50s. During the 1960s, 70s and 80s cooler conditions occurred over the North Atlantic.

Computer simulations suggest that these changes in ocean temperature affect the atmosphere above. Warmth in the North Atlantic causes a trough of low pressure over Western Europe in summer and steers rain-bearing weather systems slap-bang into the UK. The previous North Atlantic warm phase also saw a run of wet summers over the UK with notable events including the August 1952 Lynmouth floods and severe flooding during August 1948 which closed the east coast mainline railway for three months.

Professor Rowan Sutton, Director of Climate Research at the National Centre for Atmospheric Science and a researcher at the University of Reading's Walker Institute, led the research. He said,

"The North Atlantic Ocean has alternated slowly between warmer and cooler conditions over the last 100 years. We saw a rapid switch to a warmer North Atlantic in the 1990s and we think this is increasing the chances of wet summers over the UK and hot, dry summers around the Mediterranean - a situation that is likely to persist for as long as the North Atlantic remains in a warm phase."

"A transition back to a cooler North Atlantic, favouring drier summers in the UK and northern Europe, is likely and could occur rapidly. Exactly when this will happen is difficult to predict, but we're working on it."

The North Atlantic warming and cooling cycles are known as the Atlantic Multidecadal Oscillation (AMO) and they affect temperature, rainfall and wind patterns over Europe, Africa and North and South America. Previous research has suggested the warm and cold swings are related to changes in ocean circulation. Other research at Reading has suggested that it may be possible to predict the warming and cooling cycles some years ahead. During the 1990s the North Atlantic shifted to a warm state similar to that experienced during the 1930s, 40s and 50s, and this warm state has persisted to the present day. The swings in the temperature of the North Atlantic are additional to a long term (century timescale) warming trend that is mainly due to increasing concentrations of greenhouse gases in the atmosphere.

It is likely that the swings in the temperature of the North Atlantic have also been affected by human activities - both greenhouse gas emissions and other forms of pollution. Understanding how important these factors have been is a subject of active research.

Research news

Major international push to maximise bioscience research to help world's poorest farmers

Smallholders in their maize field in Kenya with Professor Zeyaur Khan (left) from ICIPE. Image: Professor Z Khan

Over 40 international research organisations are joining forces in a unique £16M initiative that will harness bioscience to improve food security in developing countries.

Funding has been awarded to 11 new research projects, announced today, which will develop ways to improve the sustainability of vital food crops in sub-Saharan Africa and Asia. The projects aim to develop staple crops better able to resist pests or thrive in harsh environmental conditions.

Food security is a major issue with over one billion people across the world already undernourished and the global population forecast to reach nine billion by 2050. These new research projects are expected to increase sustainable crop yields for farmers and their local communities within the next 5 to 10 years, and the knowledge and skills developed as part of these projects will be beneficial for crop production globally.

The grants have been awarded by the Biotechnology and Biological Sciences Research Council (BBSRC) under the Sustainable Crop Production Research for International Development (SCPRID) programme, a joint multi-national initiative of BBSRC and the UK Government's Department for International Development (DFID), together with (through a grant awarded to BBSRC) the Bill & Melinda Gates Foundation (BMGF), and the Department of Biotechnology (DBT) of India's Ministry of Science and Technology.

Deputy Prime Minister Nick Clegg said:

"One billion people currently go to bed hungry every night. By 2050 there will be another two billion mouths to feed. And experts predict the world will need to be able to grow 70 per cent more food."

"The UK's world class bioscience sector is dedicating vital knowledge and expertise to tackling this global problem. This investment will bring together experts at 14 British Universities and Institutes who will work with famers in Africa and Asia to develop crops that are resistant to disease, pests and drought."

"Farmers need these innovations to protect their own livelihoods and the health of their communities."

Minister for Universities and Science, David Willetts, said:

"This global collaboration will build on the UK's world leading position in bioscience and will benefit millions of people through improving food security in Sub-Saharan Africa and South Asia. It will help us share knowledge and forge closer links with the international research community, whilst improving skills and creating jobs in the UK."

Lynne Featherstone, Parliamentary Under-Secretary of State for International Development, said:

"Staple crops are essential to millions of farmers across Sub-Saharan Africa and South Asia, both for food and income. All too often, environmental conditions and pests cause serious crop failure, with devastating consequences for individual farmers, their families and their communities."

"Producing crops better able to grow in harsh conditions will not only tackle malnutrition, but also increase the chances for families to earn an income in order to afford education and health care, which is why DFID is providing funding to this potentially life-saving initiative."

Researchers in Nairobi at the BecA-ILRI Hub address key constraints to African agriculture. Image: David White/BecA-ILRI

Sam Dryden, Director of Agricultural Development at the Bill & Melinda Gates Foundation, commented:

"Many small farmers in the developing world cannot grow enough food to eat, let alone sell. Innovation in agriculture is vital to resolve this and we hope these projects will sustainably improve agricultural productivity, build skills and resources in developing countries, and ultimately help farming families build better lives."

Professor Douglas Kell BBSRC Chief Executive, said:

"Providing safe, affordable and nutritious food for everyone is one of the greatest challenges we face. This ground-breaking international partnership, of funders and scientists, will ensure that cutting- edge, fundamental bioscience is combined with vital local knowledge to develop sustainable, affordable solutions to increase crop yields and improve global food security."

The new initiative is being coordinated by BBSRC. The £16M is made up of £3M from BBSRC, £5M from the Bill & Melinda Gates Foundation (through a grant to BBSRC) and £7M from DFID. A further £1M has been provided by the DBT of India's Ministry of Science and Technology for projects involving India.

Each project includes at least one partner from the UK and one from a developing nation. This approach, used by BBSRC and DFID in previous programmes, aims to build scientific capacity in developing countries, with the aim of developing research teams and projects that tackle other local scientific challenges.

Examples include:

Sequencing historical DNA to tackle wheat's worst enemy

Using new DNA sequencing technologies and a variety of strains of the wheat disease 'yellow rust' from Africa, India and the UK, an international team of researchers will sequence current and historical collections of the disease to understand how it has evolved and to look at wheat genes best able to resist the pathogen in the future.

Unlocking ancient rice secrets to overcome rainfall extremes

Researchers from the UK, USA and India will work together to access valuable genetic information about variation in ancestral wild species of rice to try and identify beneficial segments of the genome that help plants survive drought.

Leaving a bad taste in aphids' mouths

Aphid-transmitted viruses pose a serious risk to beans and other major crops, resulting in large losses. An international team will survey bean-growing areas in three distinct ecological zones within Uganda to look at how virus infection shapes the distribution of aphids under natural conditions.

Reducing crop losses with cereals that respond to pest attack

Using state of the art semiochemical identification and genetic analysis technology the researchers will work with local farmers to look at different crop varieties and define genetic markers associated with the semiochemical trait to enable breeding programmes to move the trait into better crop varieties.

Exploiting wild wheat to produce better Indian varieties

Over the next five years, an international team of scientists will examine genetic variation in wild wheat species to identify traits, which could be used in cultivated varieties, providing tolerance to abiotic stresses such as heat and drought tolerance as well as biotic stresses such as resistance to pests and diseases.

Research news

Sweet answer to origins of life

New research from the Medical Research Council Laboratory of Molecular Biology (MRC LMB) has delivered a breakthrough in our understanding of the chemistry of the origins of life. Whilst some maintain that life formed elsewhere in the universe and was transported to earth, the findings, published in Nature Chemistry, suggest that the genetic material essential for all known life originated from nothing more than our primitive planet's atmosphere and the minerals on its surface.

For the emergence of life, nucleic acids (such as RNA) are a fundamental requirement. Understanding how molecules like RNA first formed is essential in understanding the origins of life but, until now, scientists have been unable to generate the two simple sugars needed to synthesise RNA.

Lead researcher Dougal Ritson, from the LMB's Protein and Nucleic Acid Chemistry division, said:

"We have discovered a way to generate the sugars needed to synthesise RNA from the simple molecules that were abundant on earth nearly four billion years ago. Ironically, the feedstock molecule is hydrogen cyanide – a molecule that is acutely toxic to us."

The research presents a giant leap forward in prebiotic sugar synthesis, and a major advance in the quest to discover the chemical reactions behind the emergence of life on earth. To make their discovery, the researchers filled a vial with degassed water (without oxygen), and then added copper cyanide and potassium cyanide. They then shone UV light on the mixture, and afterwards analysed the products by spectroscopy.

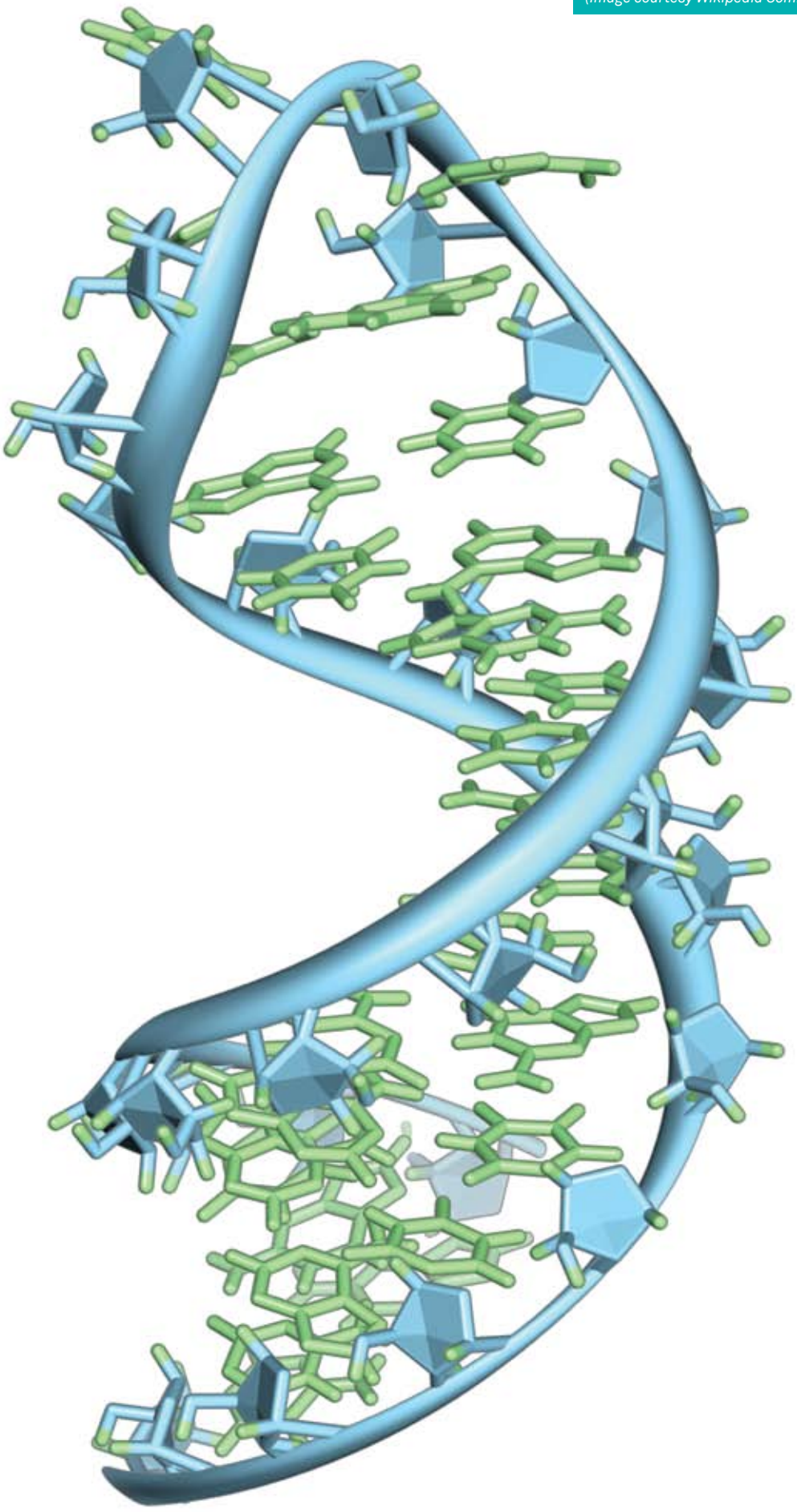
John Sutherland, a co-author on the paper, said:

"Our discovery suggests that the meteorites that collided with earth billions of years ago were a treasure trove of metals, some of which would have played a crucial role in the production of the building blocks of life. Furthermore, the conditions under which the active metal complexes formed and functioned provide unexpected novel insights into the geochemical conditions during the early phases of the earth's history."

Sir Hugh Pelham, Director of the MRC LMB, said:

"This fascinating study is a terrific example of how basic science supported by the MRC can provide important insights into some of the most fundamental questions in science – such as where we all came from. This knowledge has implications for synthetic biology which, in turn, may provide therapeutics of the future."

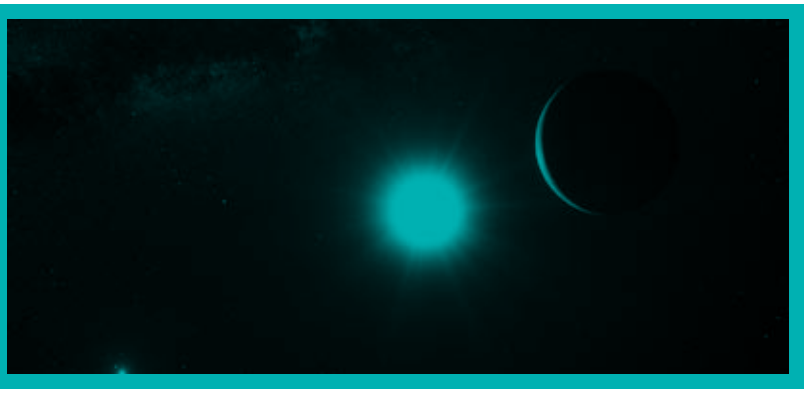
The MRC and the Engineering and Physical Sciences Research Council supported this work.



A hairpin loop from a pre-mRNA
(Image courtesy Wikipedia Commons Credit Vossman)

Research news

UK astronomers celebrate discovery of new Earth-sized planet



This artist's impression shows the planet orbiting the star Alpha Centauri B, a member of the triple star system that is the closest to Earth. Alpha Centauri B is the most brilliant object in the sky and the other dazzling object is Alpha Centauri A. Our own Sun is visible to the upper right. The tiny signal of the planet was found with the HARPS spectrograph on the 3.6-metre telescope at ESO's La Silla Observatory in Chile. (Credit: ESO/L. Calçada)

European astronomers have discovered a planet with about the mass of the Earth orbiting a star in the Alpha Centauri system — the nearest to Earth at only 4.3 light-years away. This result represents a major step towards the detection of a twin Earth in the immediate vicinity of the Sun – the Holy Grail of astronomy.

Leading British astronomers working in this research field have described this discovery as a fantastic result and a major step in the future detection of Earth-like planets.

Professor Don Pollacco from the Astronomy and Astrophysics Group at University of Warwick said:

"We think planets form in the debris left over from the formation of their stars. This discovery shows that, if we look hard enough, we're likely to find planets everywhere. These fantastic results show that to reveal the signal of such a low mass planet, not only do you need dedicated (but modest) facilities, but that understanding the normal phenomena occurring in stars is important. Here observations were obtained over many years that allow the magnetic cycle of the star (like the sunspot cycle on the sun) and its rotation period to be accounted for allowing the weak planetary signal to be detected".

Professor Isabelle Baraffe, Head of the Astrophysics group, CEMPS at the University of Exeter said:

"This is an absolutely fantastic result. The Holy Grail is to find the twin of the earth which means having a planet with the mass of the earth orbiting a sun and in a habitable zone which would favour the presence of liquid water and therefore we think would favour the presence of life. The discovery of this planet is the first step towards this Holy Grail. Of course this is not in the habitable zone as it's very close to its star - the same distance that mercury sits from our sun, so the conditions are burning at the surface of the planet. It does tell us, however, that the Alpha Centauri system has other planets. As it is unthinkable that there would be one planet in isolation, this star is a gold mine for the detection of planets".

Dr Suzanne Aigrain from the University of Oxford said:

"This is a very exciting result, because the star is so near and the planetary signal is so small. It represents a major step forwards in understanding and mitigating the effects of stellar activity, which will be crucial for the detection of increasingly Earth-like planets."

Andrew Cameron, Professor of Astronomy at the University of St Andrews said:

"This is yet another demonstration of the exquisite capability of the HARPS and HARPS-North spectrographs to measure the masses of very small planets orbiting distant stars. In the future, it will be important to combine measurements of this kind with the transit method, so we can measure their diameters as well as their masses. If we can determine their bulk composition, we will learn something about their formation history, water content and atmospheres".

The planet, the lightest ever discovered around a star like the Sun, was detected using the HARPS instrument on the 3.6-metre telescope at European Southern Observatory's (ESO) La Silla Observatory in Chile.

John Womersley, STFC Chief Executive and UK representative to ESO Council said:

"This is a very exciting result, and it demonstrates once again how scientists are pushing the boundaries in this field. It is yet more evidence of the excellence of the current ESO facilities and as we enhance our astronomy capabilities through new telescopes such as SKA and E-ELT we can expect even more spectacular results in the future".

The Science and Technology Facilities Council manage the UK subscription to ESO.

July – November 2012 membership changes

New members July - November 2012

Mem No.	Name	Grade
T14829	Miss A M Giwa-Osagie	MIScT
T14830	Miss O G Atoe	MIScT
T14831	Mr I Cakebread	MIScT
T14832	Mr A M Oligie	MIScT
T14833	Mr O Iyekowa	MIScT
T14834	Mr C Mulingo	Assoc IScT
T14835	Mr T Madziva	Assoc IScT
T14836	Mr H Adams	FIScT
T14837	Mr R M King	FIScT
T14838	Mr S Miah	FIScT
T14839	Mr T E Okuonghae	MIScT
T14840	Mrs J Hudson	MIScT
T14841	Mr M I Obasi	MIScT
T14842	Ms E M Wood	MIScT
T14843	Mr J P Temple	MIScT
T14844	Mr K Bromfield MBE	FIScT (Honorary)
T14845	Dr J Thirumalai	FIScT
T14846	Mr S A Martin	MIScT
T14847	Dr V L Talbot	MIScT
T14848	Mr J O Okeme	MIScT
T14849	Mr D Shah	MIScT
T14850	Mr J Goodier	MIScT
T14851	Mr C Gouveia	MIScT
T14852	Mr D V Renouf	MIScT
T14853	Dr Song	MIScT
T14854	Mrs O O Olupe	MIScT
T14855	Mr S Franey	MIScT
T14856	Mr A O Akinola	MIScT
T14857	Mr O A Opasola	MIScT
T14858	Mr T J Abu	MIScT
T14859	Mr K S Jones	MIScT
T14860	Mrs S K Nandanwar	MIScT
T14861	Mrs J M Cooper	MIScT
T14862	Mr T P Leigh	MIScT
T14863	Dr K Allinson	MIScT
T14864	Mr K Singh	FIScT
T14865	Mrs M Grover	MIScT
T14866	Mrs K Vere	MIScT
T14867	Miss A Lewis	MIScT
T14868	Mrs J S Harman	MIScT
T14869	Mrs L Williams	MIScT
T14870	Mr L Stott	MIScT
T14871	Mrs R E Baldwin	MIScT
T14872	Mr A R Atser	MIScT
T14873	Mrs O A Fashina	MIScT
T14874	Mr W B Prabath Premarathna	MIScT
T14875	Miss J Louth	MIScT
T14876	Mr K Amedu	MIScT
T14877	Mr J Milner	Assoc IScT
T14878	Mrs A K Ekundayo	Assoc IScT
T14879	Mr B Wadsworth	Assoc IScT
T14880	Ms Malde	FIScT
T14881	Mr A Rajan	MIScT
T14882	Dr D Turland	MIScT
T14883	Mrs J Lovell	MIScT
T14884	Dr K Henderson	MIScT
T14885	Mr A Keech	Assoc IScT
T14886	Mr R J Dainty MBE	FIScT (Honorary)
T14887	Dr L Kay	MIScT
T14888	Mr G MacLeod	MIScT
T14889	Mrs V Singleton	MIScT
T14890	Mrs D Jayesh	MIScT
T14891	Mr M D Wyles	MIScT
T14892	Mrs A L Duran	MIScT
T14893	Ms Gregory	MIScT
T14894	Mr M M Waserman	MIScT
T14895	MR A ALI	MIScT
T14896	Mr R Page	MIScT
T14897	Miss D A Henderson	MIScT
T14898	Mrs R A France	MIScT
T14899	Mr K O Ayoola	MIScT
T14900	Mr H Taylor	MIScT

Total:72

Upgrades

Mem No.	Name	Grade
T14302	Mr K Barber	FIScT

Total:1

Reinstated

Mem No.	Name	Grade
T13702	MR D R Feld	MIScT
T14424	Mrs M M Abbass	MIScT

Total:2

Science Council Registrations

Mem No.	Name	Grade
T12907	Mr J Noble	MIScT RSci
T14299	Mr I Moulson	FIScT RSci
T14698	Mr B G Palmer	MIScT RSci
T14719	Mrs M Hannah	MIScT RSci
T14753	Mr G Howell	MIScT RSc-iTech
T14788	Mr C Smith	MIScT RSci
T14791	Mr I Wraith	MIScT RSci
T14823	Mr K M Oxley	FIScT RSci
T14845	Dr J Thirumalai	FIScT RSci
T14836	Mr H Adams	FIScT RSci
T14851	Mr C Gouveia	MIScT RSci
T14837	Mr R M King	FIScT RSci
T14875	Miss J Louth	MIScT RSci

Total:13

IST organisation

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The Institute of Science & Technology

The IST CPD Award
Your key to success

The IST Continuing Professional Development Award

The IST CPD Award has been developed specifically for technicians to ensure that you have a clear route to professional and personal development and recognition for the work you do. The award means that you will be able to demonstrate to current or future employer your professionalism and competence.

As a CPD candidate you can plan and undertake activities based on competencies associated with your professional role over a period of up to 2 years. The award provides a framework within which you can identify your development needs and demonstrate that you are actively keeping abreast of new technologies, processes, and developments in your area of work.

The award is designed to be flexible in application and content, covering the needs of the more 'traditional' skills groups as well as those related to new and developmental aspects of the role and also easily tailored to meet any 'specialist' nature of a technician's role.

Key features

- On-line induction
- Development of a Personal Development Plan
- 16 generic role profiles to work from
- Evidence based competencies
- Personalised development activities
- Work based project OR dissertation
- Use of a reflective CPD log
- Underpinned by extensive learning resources

Candidates will have the support of a dedicated team of mentors, professional assessors, and access to a wide range of resources through both the IST and the heated website. In addition the communities of technicians undertaking the award share best practice and network with each other to aid their journey through the award.

On completion technicians can retain professional status by joining one of the registration schemes (see 'The IST CPD Award and the Registered Scientist, Registered Science Technician and Registered Practitioner' on our web site).

Ben Palmer, a technician working in the Department of Materials Science & Engineering at the University of Sheffield completed the IST CPD award earlier this year, explains why he undertook the award.

'I enrolled on the CPD Award as I wanted to complete a qualification that was, specific to technical staff, tailored around my role and flexible in its approach. The scheme looked a good way of documenting all of my CPD, developing my skills and driving my career forward. '

Want to find out more?
Visit: www.istonline.org.uk

The Institute of Science & Technology

Since 1987, the Institute of Science & Technology has operated a Register of competent and qualified technical practitioners

IST CPD Award
Registered Practitioner
Registered Science Technician
Registered Scientist

Not Working in Science or Science Technology?

IST Registered Practitioners

The Institute of Science and Technology is uniquely an organisation run by technicians for technicians. We support these incredibly important staff in all areas, not just science but technologists in all fields.

As the professional body for specialist, technical and managerial staff, we are actively involved in the professional recognition of technical staff in education, research, government, and industry. It is our view that our Registration Schemes are essential to establish your professional standing, acknowledge your expertise and to enhance your career prospects.

Technicians and technologists working in non-science fields may not be eligible to join the Science Council's Registers but the IST recognises the exceptional work that technicians and technologists working in non-science fields do. We are committed to providing all our members with a means to endorse their status and to enable them to demonstrate transferable skills, up-to-date professional competence, and continuing professional development. We do this through our Registered Practitioner Scheme and by the designation of MIScT(Reg) or FIScT(Reg) status to members who meet the criteria.

Registered Practitioners must have attained a high level of technical proficiency supported by sufficient knowledge of modern technology to enable them to relate to operating practices in their chosen field.

Criteria for Registration include:

- Corporate Membership of the Institute of Science & Technology
- Higher National Certificate or Diploma (other qualifications judged to be of equivalent standard also satisfy the requirements)
- NVQ/SVQ level 3 or 4 in an appropriate occupational area
- Completion of the HEaTED/IST CPD award*
- Appropriate experience (in terms of breadth, depth and length)

Importantly, there is also a route for mature applicants who have achieved a high standard of professional competence but who may not have the formal academic qualifications.

Registration is renewed each year with evidence of Professional and Personal Development. There is a fee for admission to the Register and a nominal annual renewal fee.

* The IST CPD award can be used to demonstrate CPD activity for the RSci, RSciTech and RegPrac schemes and fulfill associated registration scheme competencies. Individuals automatically become members of the IST, and although the IST CPD award is not a qualification it does allow the individual to formally demonstrate work based experience and learning.

Want to find out more?
Visit: www.istonline.org.uk

The Institute of Science & Technology

Application for membership

Before completing this form please read the Notes for Guidance for Applying, available at www.istonline.org.uk. All relevant sections of the following form must be completed, even when additional information is provided on a separate sheet. New members apply to join on the basis that the appropriate grade of membership will be awarded by the Institute on acceptance, and that the level will be determined by the details supplied on this form.

When the applicant is notified of the grade of membership offered by the Institute a request for the appropriate membership fee will be made. Personal details collected in respect of applications will be treated in the strictest confidence and every effort is made to ensure that data is held securely.

I agree to my details being passed onto individuals involved in the application review process.

Please accept my application for membership. If accepted I agree to abide with the by-laws of the Institute.

Signed: ..... **Date:** .....

PERSONAL DETAILS

Title (Dr/Mr/Mrs/Miss/Ms): .....

Surname: .....

Other Names: .....

Date of Birth: .....

Home Email address: .....

Telephone: .....

Address for correspondence: .....

.....

.....

A. DETAILS OF PRESENT POST

Job Title: .....

Date of Appointment: .....

Employer Name: .....

Employer Address: .....

.....

Email: .....

Type of work or discipline: .....

.....

Brief details of practical work undertaken in the year prior to application:

.....

.....

.....

B. PREVIOUS EMPLOYMENT HISTORY

Date	Employer	Type of Work/ Status/Title/Discipline
.....	.....	.....
.....	.....	.....
.....	.....	.....

C. QUALIFICATIONS

Give details below of any examinations passed, prizes or scholarships awarded etc. (Documentary evidence must be forwarded with this form, scanned images in jpg format are acceptable)

Date	Examinations/Prizes/ Scholarships etc	Institution
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

Continued overleaf

The Institute of Science & Technology

D. COURSES & OTHER RELEVANT DETAILS

Give details below of any courses you have, or are attending, membership of other professional bodies, published work etc.

Date	Courses/Professional Bodies/Publications etc
.....	.....
.....	.....
.....	.....
.....	.....

E. REFEREE

Give name, qualifications and full address of your manager or Head of Department/Supervisor, who need not be a member of the Institute, who knows you personally and who would confirm the particulars on this form and who would support your application for membership of the Institute.

Name: .....

Position:.....

Organisation: .....

Qualification(s):.....

Email:.....

Address:.....

.....

.....

Send to: Institute of Science Technology
Kingfisher House
90 Rockingham Street
Sheffield SE1 4EB

Email: office@istonline.org.uk

FOR OFFICE USE ONLY

Application received: .....

Registration fee received: .....

Referee form sent: .....

Applicant notified: .....

Grade awarded:.....

Membership fee received:.....

Membership No:.....

Membership card & Diploma sent:

.....

Direct debit instruction received:

.....

IST Registered Practitioners

Since 1987, the Institute of Science & Technology has operated a Register of competent and qualified technical practitioners. As the professional body for specialist, technical and managerial staff, we are actively involved in improving the status of, and the services offered by, technical staff in education, research, government and industry and it is our view that the Registration Scheme for laboratory and other technical practitioners is essential if their status, career prospects and expertise are to be recognised and enhanced, or indeed maintained.

Registered Practitioners must have attained a high level of technical proficiency supported by sufficient knowledge of modern technology to enable them to relate to operating practices in their chosen field.

Criteria for Registration include:

- Corporate Membership of the Institute of Science & Technology
- Higher National Certificate or Diploma (other qualifications judged to be of equivalent standard also satisfy the requirements)
- NVQ/SVQ level 3 or 4 in an appropriate occupational area
- Completion of the HEaTED/IST CPD award
- Appropriate experience (in terms of breadth, depth and length)

There is also a route for mature applicants who have achieved a high standard of professional competence but who may not have appropriate formal academic qualifications.

Registered Practitioners are permitted to use the post-nominal, designatory letters **MIScT(Reg)** or **FIScT(Reg)**.

Registration must be renewed each year and the renewal application should be accompanied by evidence of Professional and Personal Development. Registered practitioners may be removed from the Register if:

i) they fail to undertake any PPD in a 4-year period, or

ii) there is evidence that their professional conduct falls below the standard expected, or

iii) they cease to be a technical practitioner.

There is a fee for admission to the Register and a nominal annual renewal fee.

For further information, and an application form, contact the IST office or visit our website.

www.istonline.org.uk

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