The Institute of Science & Technology

The Professional Body for Technical, Specialist, and Managerial Staff

The Journal

Autumn 2017

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The Journal

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Autumn 2017

The Professional Body for Technical, Specialist, and Managerial Staff

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Editor's welcome

Welcome to the Autumn 2017 edition of the IST Journal.

Ian Moulson
Editor

Welcome to the 2017 autumn edition of the IST Journal. As always, we feature some really excellent articles, which I hope you enjoy reading. This edition has a piece on our hugely successful IST Conference that took place in Leicester in September. A brilliant day, with great speakers, superb workshops, terrific networking opportunities for the 250 delegates, and all organised and run by our terrific IST conference team.

Inside is also news and information about the IST, plus what we are doing and what we plan to do as we continue to actively support our members and the technical community.

Our membership is rising and the number of professional registrations through the IST continues to grow. So we are all busy, busy, and busy. What we need are a few more volunteers.

All the members of the Executive and its support team are volunteers, are unpaid, and give their valuable time freely. Why? you might ask. Well it's because we all care. We care that technicians, of every discipline and organisation, should be given the recognition that they deserve. And, we believe the way to do that is to organise ourselves, support each other, and beat our own drum. We are an organisation for technical people and run by technical people. So if you want to help, and join the team in running your institute, then please let us know.

I am absolutely delighted that Andy Connelly has joined the IST's team of volunteers as Assistant Editor of The Journal. Andy works in the School of Earth and Environment at the University of Leeds as a laboratory technician and manager. His #technicianjourney started out with a MEng in Materials Science and Engineering from the University of Sheffield in 2000. He followed that with a PhD in glass science and then spent two years as a post-doctoral researcher in France and in the UK. Unhappy with the uncertainty of academic life, he spent three years teaching high school physics before stumbling across his current role as a technician in 2013.

Andy is convinced that he has found his ideal role within science – helping PhD students and academics achieve their goals, running an active laboratory, and trying to keep lab users safe, usually from themselves!

Andy enjoying his "day job" doing field-work with his students

He will work with me and our small, hardworking, team to produce a publication all IST members can be proud of. Andy brings with him his valuable experience as an amateur science writer and editor of the University of Leeds Technicians' Network newsletter, Technically Speaking. He hopes to use his new position to highlight the vital role that technicians play within all sectors, from science and engineering to art, industry, and more. His aim is to make you, the IST's members, central to The Journal by introducing more articles about members' #technicianjourney and to encourage more members to write articles.

Excited to take on his new challenge as Assistant Editor, Andy looks forward to hearing from you. He wants to hear your article ideas, your achievements, and the names of technicians with interesting stories to tell.

You can contact Andy at **andyconnelly@istonline.org.uk**

Our online newsletter has been an outstanding success, and it is a great avenue for you to let us know your news and what's happening in your "technical world". Its editors are:

Natalie
n.j.kennerley@
istonline.org.uk

Kevin
k.m.oxley@
istonline.org.uk

so please feel free to contact them, or our IST Office **office@istonline.org.uk**

Twitter (@istonline) – we encourage ideas, feedback, and discussions using #istforum

Sad news

I received some very sad news recently that Roger Olivant, a previous colleague of mine at the University of Sheffield, died on October 18th.

Before his retirement Roger was the Departmental Manager of the Physics Department. I got to know him early on in my career at UoS when I was a relatively inexperienced technical manager in the Faculty of Engineering. We were brought together through a rather unique and out of the ordinary request to train technical staff at Addis Ababa University in Ethiopia. The two week trip, funded by the British Council, was in the 1990's a year or two after their 30 year civil war ended in 1991. AAU was trying to get back to normal and having effective technical support was an important and key aspect of that.

It was an extremely busy two weeks for us, intense, hard work, and exhausting. But what an opportunity, we both really enjoyed it. I also learnt a lot through the short time I worked with Roger. He was a natural and talented manager; a "what you see is what you get" guy, always positive and up for a challenge. Roger was an accomplished technician, a great communicator, and an excellent technical manager.

He is sadly missed.

A photo that I took of Roger and AAU colleagues enjoying a well deserved beer after work.

Ian

Chairman's view

Terry
Chairman

Another summer over and the suntan is fading, where has the time gone? Well for your IST team it's been lots of travel - visiting companies, universities, and other institutions around the UK, promoting the role of the professional technician and furthering the technical community's visibility. The Executive has been involved in a variety of meetings with key partners at the national level: all with great success.

July and a summer workshop at Edinburgh University with Kirsty Robertson and technical staff

A large part of the team and additional volunteers have spent many days of the summer preparing for our recent successful IST conference, which took place on 14th September. Feedback to date has been excellent with many delegates and sponsors saying "the best (conference) to date." So a very BIG THANK YOU to everyone involved.

As they say no rest for the wicked. After having taken a short breather the conference team has now started to work on next year's event in Newcastle – so the date for your diary is September 2018.

The IST's Charity of the Year is the Down's Syndrome Association's WORKFIT initiative, which strives to give meaningful employment to people with Down's Syndrome. James Trout, our IST Industry Liaison Advisor, has been leading this partnership on behalf of the IST. Through his day job, as Laboratory Manager for the National Laboratory Service, James has been able to broker a number of employment opportunities at the service's sites in Exeter and Leeds under the WORKFIT banner. To acknowledge this success, the IST has agreed to extend its support for this initiative for a further year so remember to buy your WORKFIT socks!!! Contact James for details at **j.trout@istonline.org.uk**

The WORKFIT stand at this year's IST Conference in Leicester

More and more technicians, technical managers, and specialists continue to attain professional recognition through the IST by becoming registered on the Science Councils National Professional Registration Scheme. Our teams are here to help and guide you through the process. For further information see our website at **istonline.org.uk/professional-registration** or drop an email to **office@istonline.org.uk**

A recent long journey to Edinburgh University was highly rewarding. There I meet a group of technical staff and managers who were trying to make a difference for their technical community. I received a warm welcome from the Edinburgh University staff. They are a highly engaged group of people who are determined to make most of our workshop sessions. A number of topics were actively discussed resulting in a very productive day. Once again I was able to take a moment to recognise and congratulate on behalf of the IST the commitment and achievements of Val Gordon by awarding her a Fellowship of the IST; a great end to a great day.

Val Gordon accepting her IST Fellowship award

To finish this edition's Chairman's view, I would like to thank members and supporters who have been sending me comments, ideas, and offers of help. As I always say this is YOUR Professional Body and we really do value your input. This enables us to achieve our main objective, which is to deliver a professional body that works for its members and meets our rider "run by technicians for technicians". So please keep those comments and offers of help coming in. Email **t.croft@istonline.org.uk**

Best wishes

Terry

As the Journal was going to press I was given the sad news that Roger Olivant had passed away in the early hours of Wednesday 18th October. Roger was the Laboratory Superintendent/ Departmental Manager in the Department of Physics and Astronomy at the University of Sheffield. His career spanned a number of roles from 1964 until his retirement in 2005. An article on Rodgers career will be available in the Spring 2018 Journal. Our deepest sympathy goes out to Marcus and his family.

New members and registrations

New members April 2017 – October 2017

Membership No.	Name	Grade
T15811	Mr T Dickson	MIScT
T15817	Dr H Abbas	FIScT
T15819	Mr N J Beckett	MIScT
T15820	Miss E Boyd	MIScT
T15821	Ms J Willis	AssocIScT
T15822	Dr J Davey	MIScT
T15823	Mrs A Elliott	MIScT
T15824	Mrs K Parnell	MIScT
T15825	Dr C C Prates-Clark	MIScT
T15826	Mr E O Uwadiae	MIScT
T15827	Mr A J Copley	MIScT
T15828	Mr K F Erskine	MIScT
T15829	Mr Lowndes	MIScT
T15830	Dr K Leslie	MIScT
T15831	Dr R Nicholas	MIScT
T15832	Ms N Steinberg	MIScT
T15833	Mrs H Ford	MIScT
T15834	Mrs L J Humphrey	MIScT
T15835	Mr S Baker	MIScT
T15836	Dr R S Cutting	MIScT
T15837	Mr G O Osunde	MIScT
T15838	Mr C D Evans	MIScT
T15839	Dr L Ganderton	MIScT
T15840	Mr A Wood	MIScT
T15841	Miss N Coplin	MIScT
T15842	Dr L A Griffiths	MIScT
T15843	Mr G G Stammers	AssocIScT
T15844	Mr G Newman	AssocIScT
T15845	Miss A Eades	AssocIScT
T15846	Mr N Gillott	AssocIScT
T15847	Mr R Abbott	MIScT
T15848	Mr A Thornton	AssocIScT
T15849	Miss N Rickards	AssocIScT
T15850	Mr L Weymouth	AssocIScT
T15851	Mrs Krah-Boamah	AssocIScT
T15852	Mr J Kirkwood	MIScT
T15853	Mr S Miah	MIScT
T15854	Miss H S Scott	MIScT
T15855	Miss A Farbos	MIScT
T15856	Mrs S L Fay	MIScT
T15858	Mr M Kirkland	AssocIScT
T15859	Mr L S Dawkins-Hall	MIScT
T15860	Miss L Petch	MIScT
T15861	Dr K S Galea	MIScT
T15862	Mrs L J Van Hateren	MIScT
T15863	Mr J Bishop	AssocIScT
T15864	Mr N Turton	MIScT
T15865	Mrs A T Bello	MIScT
T15866	Mrs W Bal	MIScT
T15867	Mr G Schkzamian	MIScT
T15868	Mrs S Meredith	MIScT
T15869	Mr J D Grist	MIScT
T15870	Miss B Brandmeier	MIScT
T15871	Miss S Zito	MIScT
T15872	Dr E Hackl MSc	MIScT
T15873	Prof. Dr Mr A E M Mohamed Saleh	FIScT
T15874	Mr L A Ndiyo	AssocIScT
T15875	Mrs N L Okenwa	MIScT
T15876	Mrs M A Wade	MIScT
T15877	Mrs C Summers	MIScT
T15878	Mr P R H Cave	MIScT
T15879	Mrs I Baleanu	MIScT
T15880	Mr K Kumaraswamy	AssocIScT
T15881	Miss E L Peake	MIScT
T15882	Mr M J Percival	MIScT
T15883	Dr N Tipping	MIScT
T15884	Miss H Usman-Sani	MIScT
T15885	Mrs C O Ekwueme	AssocIScT
T15886	Mr R C Agu	MIScT
T15887	Dr S L Williams	MIScT
T15888	Mr C R J Kenyon	MIScT
T15889	Ms A M Beddows	MIScT
Total: 72		

Science Council Registrations

Membership No.	Name	Grade
T15220	Mr L Shunburne	CSci
T15469	Dr E M Fitzcharles	CSci
T15708	Mr M S Gillman	CSci
T15764	Dr H Chang	CSci
T15784	Mr L Lee	CSci
T15832	Ms N Steinberg	CSci
T15833	Mrs H Ford	CSci
T14493	Miss R M Perry	RSci
T15489	Dr T H Bishop	RSci
T15513	Ms M King	RSci
T15528	Mr P Morgan	RSci
T15574	Dr A I Tochwin	RSci
T15721	Mrs K Bolden	RSci
T15766	Mr S Le Geyt	RSci
T15792	Mr J D Wright-Mullaney	RSci
T15798	Mr C D George	RSci
T15808	Miss G Garland	RSci
T15814	Miss M La Trobe	RSci
T15822	Dr J Davey	RSci
T15823	Mrs A Elliott	RSci
T15824	Mrs K Parnell	RSci
T15830	Dr K Leslie	RSci
T15831	Dr R Nicholas	RSci
T15834	Mrs L J Humphrey	RSci
T15835	Mr S Baker	RSci

Membership No.	Name	Grade
T15842	Dr L A Griffiths	RSci
T15854	Miss H S Scott	RSci
T15855	Miss A Farbos	RSci
T15859	Mr L S Dawkins-Hall	RSci
T15866	Mrs W Bal	RSci
T15868	Mrs S Meredith	RSci
T15869	Mr J D Grist	RSci
T15870	Miss B Brandmeier	RSci
T15872	Dr E Hackl	RSci
T15625	Miss J Mehers	RSciTech
T15687	Miss J Hooson	RSciTech
T15699	Mr J D Coe	RSciTech
T15783	Miss S H Watson	RSciTech
T15807	Miss H J Collier	RSciTech
T15810	Mr A Bretherton	RSciTech
T15818	Mrs S Moss	RSciTech
T15820	Miss E Boyd	RSciTech
T15828	Mr K F Erskine	RSciTech
T15840	Mr A Wood	RSciTech
T15841	Miss N Coplin	RSciTech
T15871	Miss S Zito	RSciTech
T15881	Miss E L Peake	RSciTech
T15882	Mr M J Percival	RSciTech
Total: 48		

IST Organisation

IST Executive Board Members

President: Helen Sharman OBE FRSC FIScT

The main role of the President is to lead and guide the Institute in its strategic and operational development. Helen is ideally suited to this role having become the first British astronaut when she launched into space on board a Soyuz space craft on 18 May 1991. Helen graduated with a degree in chemistry from the University of Sheffield before working in industry. Following which she trained at the Yuri Gagarin Cosmonaut Training Centre in Star City near Moscow. Helen became a science communicator after her space flight, and more recently she has started a new career in management, working at the National Physical Laboratory and at Kingston University London, before moving to Imperial College in the summer of 2015.

E: office@istonline.org.uk

Chairman: Terry Croft MBE FIScT CSci

Terry is the Chairman of the IST. He is passionate about and is committed to the technical community. His work involves promoting the professionalisation of the technical workforce. He brings a wealth of experience to the board through his involvement with the wider sector and as Director of the Catalyst Project, titled "Development of Career Pathways for Technicians across the Higher Education Sector."

E: t.croft@istonline.org.uk

Secretary: Natalie Kennerley FIScT CSci

Natalie became the IST Secretary in May 2016, and has responsibility for ensuring that we comply with legislative requirements and that we maintain suitable official records. Natalie is also Public Relations Advisor, and in that role she represents the IST at events, conferences, exhibitions, and open days. Planning PR campaigns and strategies as well as writing and editing marketing material are also key. In addition, she is a Senior Assessor, assessing applications for Registered Science Technician, Registered Scientist, and Chartered Scientist.

E: n.j.kennerley@istonline.org.uk

Finance Officer: Joan Ward FIScT

As Finance Officer, Joan's primarily role is to control expenditure on behalf of the Executive and be responsible for ensuring that satisfactory accounts of all monies received and expended are maintained. Further to this, Joan provides advice as to how annual financial performance might be improved, within the context of the IST being a not-for-profit organisation. She carries out any tasks agreed by the Executive to maximise overall financial wellbeing.

E: joanward@istonline.org.uk

Education Officer: Philippa Nobbs FIScT

As Education Officer, Philippa maintains knowledge of vocational training and qualifications for technical practitioners. She also participates in regional and national development programmes. Philippa has a long history of involvement in the development and delivery of technician training and led the introduction of the IST's service to employers to validate their in-house training schemes.

E: education@istonline.org.uk

Marketing Officer: Ian Moulson FIScT

As Marketing Officer, Ian looks at new and existing ways in which the IST markets itself to its members, prospective members, and the science and technology community. He is editor of the IST's biannual publication 'The Journal' and chair of its editorial panel, which oversees the quality of its articles and other content.

E: i.moulson@istonline.org.uk

Membership Development Officer: Kevin Oxley FIScT CSci

As Membership Development Officer, Kevin develops strategies for membership engagement with the IST. Working alongside the Marketing Officer and PR Advisor, Kevin develops the implementation of recruitment and retention campaigns. He also promotes the benefits of membership to Higher Education institutions and industry. Kevin is also the Institute's Diversity Champion and works to ensure that the IST operates in line with the principles of diversity, equality, and inclusion, and to measure progress in that regard.

E: k.m.oxley@istonline.org.uk

Registrar: Michelle Jackson FIScT CSci

As Registrar, Michelle oversees the registration schemes run through the IST and contributes to the development of associated strategic and operational procedures. She liaises with the Science Council with respect to continuing development of the registration process and monitors all aspects of the IST registration and assessment processes.

E: michellejackson@istonline.org.uk

Fellowship & Overseas Officer: Derek Sayers FIScT FInstLM FRMS

As Fellowship & Overseas Officer, Derek coordinates the review of Fellowship applications, setting in place panels of other Fellows for peer review, and advises the Executive on the outcome of the reviews. He also maintains the documentation of those applications. Derek is our point of contact for overseas inquiries from members and for organisations wishing to work with the IST; he liaises with such organisations and reports back to the Executive.

E: dereksayers@istonline.org.uk

Executive support/advisors

Administrator: Wendy Mason

Wendy supports our memberships, registrations, committees and meetings, and manages the IST's office. She deals with all our general enquiries and helps to organise our events, visits, and conference. She also coordinates and supports training courses (eg. Leading Your Technical Team) and examinations (eg Higher Diploma).

E: office@istonline.org.uk

China Advisor/Representative: Geoffrey Howell MIScT RSci

Geoff is a member of the IST Education Board and one of the assessors for professional registration. His background is in training and he now leads the first International Technical Training Programme in China as part of an ongoing IST Project.

E: g.howell@istonline.org.uk

Partnerships/Champions Coordinator: John Dwyer FIScT

John is co-ordinator for Partnerships/Champions. His role involves actively promoting professional registration for the IST throughout the UK: attending meetings, workshops, and conferences, and seeking champions for this cause at institutions nationally.

E: J.dwyer@istonline.org.uk

Social Media/Engagement Advisor: John-Paul Ashton MIScT RSci

John-Paul has recently taken on a social media advisory role and will be helping the Executive develop its profile/presence across various social media platforms including Twitter, Facebook, and LinkedIn. He will also work closely with the Executive to enhance engagement with the wider technical community.

E: j.p.ashton@sheffield.ac.uk

Industry Liaison/Advisor: James Trout FIScT CMgr RSci

James is the Laboratory Manager for the National Laboratory Site at Starcross in Devon. The NLS is a national service of the Environment Agency and provides analytical data for a range of sample types. James is a Chartered Manager and a Governor of Newton Abbot University Technical College. He will be helping the IST develop industrial links and promoting frameworks for professionalising science/technical staff working in that sector.

E: j.trout@istonline.org.uk

Assistant Editor: Andy Connelly MIScT

As the Assistant Editor of the IST's biannual publication "The Journal" Andy works with the editor and editorial panel, to oversee the quality of its articles and other content. Andy has been writing and publishing both academic papers and popular science articles since 2007. He also works with the IST's Marketing Team looking at new ways that we can highlight the vital role of technicians and the technical community through our publications.

E: andyconnelly@istonline.org.uk

Education Board:

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Ian Gray MIScT
Geoff Howell MIScT
Michelle Jackson PhD, FIScT
Christoforos Pambou MIScT, RSci

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John Ayres, Glasgow School of Arts
Katherine Forsey PhD, HEaTED
Sue Churm, HEaTED
Daniel Jagger MBA, Cambridge School of Arts

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Kevin Oxley FIScT, CSci
Joan Ward FIScT

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Maida Davidson FIScT
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Robert Hardwick FIScT
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Prof. N-S Zhong

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Stephen Gamble MIScT, FIBMS
Natalie Kennerley FIScT, CSci
Kevin Oxley FIScT, CSci
Joan Ward FIScT

Chartered Scientist
Registered Scientist
Registered Practitioner
Registered Science Technician
IST CPD Award

Application for IST membership

Membership

Kevin Oxley FIScT, CSci IST Membership Development Officer

Membership of the Institute is open to specialist, technical, and managerial staff in a broad range of environments such as science, engineering, industry, local authorities, schools, FE, HE, research/analytical/ health facilities, government departments, and many more in the UK and overseas. There are five grades of membership in the Institute. An applicant does not initially apply for a specific grade of membership, the grade offered by the Institute being dependent upon the qualifications and experience of the applicant.

Why Join?

To help us maintain, build and expand the (IST) community.

Together we are a voice that is heard and listened to.

IST can help by supporting and developing your:

- professional standing
- knowledge and skills
- network of contacts
- career and interests

Application for membership at Junior, Affiliate, Associate, and Member grades can be made by email or by post to the IST office using the standard application form which is available for download (**http://istonline.org.uk/membership/**). The form must be accompanied by a copy of each relevant certificate, diploma etc. (scanned copies sent electronically are accepted). Completed applications should be emailed through to **memberships@istonline.org.uk** or posted to our Sheffield Office. Membership Application Notes for those applying for membership are available (**http://istonline.org.uk/membership/**).

The IST's UK membership hot-spots

When an application has been accepted, the applicant will be notified of the grade offered, at which time a full subscription payment will be required (within one month of notification). After the subscription has been received the new member's name will be added to the Register of Members and a Certificate and member's card will be sent. Following entry on the Register members are entitled to use the designated post-nominal letters relevant to their grade.

Annual membership fees are:

- Junior: £5
- Affiliate: £20
- Associate: £35
- Member: £45
- Fellow: £58

*Retired or unemployed members can claim a reduction of 50% off the normal rate

Previous members whose membership may have lapsed can apply for reinstatement by completing and returning a Membership Reinstatement Form to **memberships@istonline.org.uk**

Payment of subscriptions can now be made online

Diversity

Kevin Oxley

In addition to the moral, ethical, and legal reasons for addressing diversity, equality and inclusion there are also compelling arguments and evidence for supporting increased equality and diversity in the science workforce. I want to consider the ways in which we can bring benefit to our own organisation and help our members to engage with the diversity agenda. As the diversity champion for the IST, my aim is to ensure that the IST is operated in line with the principles of diversity, equality and inclusion. The IST signed up to the Science Council's Declaration on Diversity, Equality and Inclusion in 2014. This declaration set out the strategic ambition of working towards a science workforce that reflects the diversity of society.

The Science Council is undertaking a programme of work aimed at raising awareness of the importance of diversity as an issue of concern for professional bodies, while providing leadership within the sector to increase commitment and investment. Over the next few issues of the journal I would like to talk about diversity and inclusion in our profession and how we as members, and the IST as a professional body, can engage with this agenda.

When a member of the public is asked to think about their stereotypical image of a scientist, they will often imagine some irate professor from a Hollywood movie who looks something like Albert Einstein with mad hair and an agenda to suit. And yes, I've come across some mad scientists in my time, but only because they were totally focussed on their curiosity of discovery, of breaking down knowledge barriers, or finding a cure for a disease. An academic career in science, across any number of disciplines that you can imagine, will also probably be their stereotypical image of what a career in science would look like.

A researcher, a lecturer, or a professor - those traditional graduate routes and careers in science are still there, but the thing that science really looks for is talent. Look closer under the surface of our industry and you will discover a wide group of specialist, technical, administrative, and managerial careers in a broad range of scientific environments such as medicine, engineering, local authorities, schools, the health industry and many more, in the UK and overseas. You will find a vibrant community of talented specialists who work together to help make a difference and shape the future.

However, in this country the science industry does have the problem of not having sufficient representation from BME (black and minority ethnic), at all levels. BME groups accounted for about 13% of the academic workforce in higher education, and only 10% in non-academic roles in 2016 according to HESA; a charitable company that operates on behalf of the UK government to collect data about higher education.

Recent analysis by the Royal Academy of Engineering suggests that we will need more than a million new engineers and technicians by 2020. This will require a doubling of the current number of annual engineering graduates and apprentices. The Science Industry Partnership published its first skills survey into UK science in 2015, which estimates that overall, the science industries in the UK will need 180,000 to 260,000 new staff by 2025. This forecast includes up to 142,000 professional level graduate entry jobs and up to 73,000 technical level apprenticeship entry roles. Without doubt then, there are great opportunities for a career in science, and a huge demand that will need to be filled by those who are inspired to join the science community.

In March, we celebrated National Apprenticeship week, and in April the Government apprenticeship levy scheme started, with its plans to train 3m new apprentices by 2020. Apprenticeships and trainee schemes can offer an alternative route to science through on-the-job skills, experience, and qualifications all the way up to master's level. For employers apprenticeships can provide the talent, and the skills that they will need for their organisation to succeed. The science industry is looking to capitalise on the government's scheme, and to fully utilise apprenticeships to help fill some of that 260,000 gap in science careers.

The world of science and technology moves forward at a tremendous pace, and is one of continual and rapid change. This modern technology-driven world has opened up many new and exciting fields of science. Increasingly, the multi-disciplined approach towards developing new and innovative solutions is changing

the face of industry, research and education. Science is also trying to reach out more to people every day, to explain what we do, and to excite and arouse interest through science festivals and events. We bring schoolchildren into universities to inspire them to dream bigger dreams. People who come along to those events and festivals are often enthused by what science does and amazed at all its diversity of ideas.

The science industry, from employers across all sectors, to professional bodies such as the Institute of Science & Technology, who represent the scientific community, are all committed to working towards improving the diversity of the science workforce through any number of frameworks and initiatives.

Author

Kevin Oxley FIScT CSci.

Kevin is the Institute's Diversity Champion and works to ensure that the IST operates in line with the principles of diversity, equality and inclusion and to measure progress in that regard. He is also the IST's Membership Development Officer helping to develop strategies for membership engagement. Working alongside the Marketing Officer and PR Advisor, Kevin develops the implementation of recruitment and retention campaigns. He also promotes the benefits of membership to Higher Education institutions and industry.

E: k.m.oxley@istonline.org.uk

IST Technical Conference 2017 – Leicester

IST Team

It was a beautiful, blue sky day in the centre of Leicester where people were arriving for the 2017 Institute of Science and Technology's (IST) national conference. There was a buzz of anticipation as people queued at the conference reception desk in the Grand Mercure Hotel. Old friends caught up and new friends were being made, as people moved into the marble pillared main hall for a drink and a chat. Around the edges of the hall were sponsor's stands, offering a chance to view the latest technologies and equipment. Delegates mingled with company representatives and with representatives from bodies such as the Science Council, Heated, and the TDM project. Everything a technician could ask for was there, coffee included.

Terry opened the conference, which was attended by well over 250 delegates. (Credit: Keith R. Barber FIScT CPAGB LRPS)

At 10am we were all ushered in to the Queens Hall for Terry Croft to officially open the conference. Terry, the IST's chairman, revealed the fantastic news that the IST's membership was growing, as had interest in professional registration for technicians. He praised the initiatives from the Science Council and Gatsby Foundation for increasing the visibility of technicians. "Now is a great time to be a technician" he said, "and a great time to be part of the IST". He also explained that the IST would continue its support of WorkFit, an initiative run by the Down's Syndrome Association, dedicated to finding meaningful employment opportunities for people with Down's Syndrome. His speech ended with a call for volunteers, "With an increasing membership and our involvement with a number of projects and bodies at national level", he said, "there is a need for more volunteers to become part of the specialist teams supporting this work. This is an exciting opportunity to play a part in the IST and make a difference". He then thanked the sponsors and welcomed the opening speaker, Dr Turi King.

Dr Turi King Dr Turi King, Reader in Genetics and Archaeology at the University of Leicester, enthralled us about her work leading "The King's DNA analysis in the Richard III identification project" (Credit: Keith R. Barber FIScT CPAGB LRPS)

Turi was the first of two fantastic plenary speakers. For a conference in Leicester there could not be a more relevant talk than one about the discovery and identification of Richard III. She described the hunt for Richard's grave as a, "Historical missing persons case" and went on to describe how they had managed to solve it; of course, with the help and support of technicians. The story had more twists and turns than a Sherlock Holmes novel but Turi's clear explanations and eye for amusing detail kept us all captivated. The round of applause at the end showed just how much everyone had loved this historical murder mystery. As the applause died down there was just time for questions before we went on our separate ways to the first set of workshops.

At these times, the conference hall empties and the sponsors get a well-earned break. However, the hour soon ticked around and the hall filled back up as quickly as it emptied. There was time for more coffee, biscuits, for the sharing of new ideas, and for chatting to the exhibitors before everyone headed off again for the second set of talks.

Lunch and sponsor exhibition (Credit: Keith R. Barber FIScT CPAGB LRPS)

Lunch had the hall humming with hungry technicians fresh from a morning of interesting seminars and socialising. The conference was half way through but it felt like it had only just begun. A wonderful buffet of hot and cold food was laid out for us, there were even chips! It was a group of well-fed technicians that filed back into Queens Hall for the next plenary speaker; however, there'd be no post dinner snooze in Professor Anu Ojha's presentation, he was much too good a speaker.

Professor Anu Ojha, OBE, Director of the UK's National Space Academy programme and a Director of the National Space Centre - the UK's largest visitor centre for space science and astronomy (Credit: Keith R. Barber FIScT CPAGB LRPS)

Anu is the Director of the UK's National Space Academy Programme and a Director of the National Space Centre, based in Leicester. His talk opened with a controversial statement, "Space, what's the point?" At the end of the talk, no one was in any doubt about the importance of space; not just of looking outwards, but also for looking back at our "pale blue dot." He showed us just how much we can learn about our planet by using the satellites and how important that information would be to our expanding population. He was a charismatic speaker with some incredible images and an encyclopaedic knowledge of his subject. I think we'd all have followed him onto a spaceship to Mars at the end of the hour; he certainly got bombarded with questions when the round of applause died down.

Workshop 6: Social Media & Marketing: Evolution or revolution? John-Paul Ashton & Lizzy Gifford (Credit: Keith R. Barber FIScT CPAGB LRPS)

The third and final set of workshops followed swiftly on and we were all sadly aware that the day was drawing to a close. The general consensus seemed to be that this year's conference was one of the best yet. It had a fantastic series of talks, a great turn out, amazing plenary speakers, and sponsors who were totally engaged and committed to the conference. This combination ensured that everyone was boiling over with enthusiasm in an atmosphere that was buzzing.

(Credit: Keith R. Barber FIScT CPAGB LRPS)

There was a tired but happy atmosphere in the Queens hall for Ian Moulson's closing remarks and prize giving. What a day it had been, over all too quickly. Katherine Whitley had won the poster competition with a fantastic poster about fruit flies at the University of Sheffield and received her prize of an iPad mini. We were reminded that it would be a whole new year before we all met again, in Newcastle for the IST 2018. I, for one, am looking forward to seeing you all again, and taking part in what will be another fantastic conference.

Geoff Passmore receives his IST Fellowship from Terry Croft (Credit: Keith R. Barber FIScT CPAGB LRPS)

Katherine Whitley receives the prize for best poster display from Terry Croft (Credit: Keith R. Barber FIScT CPAGB LRPS)

Example reviews of just three of the day's fifteen workshops

Workshop 7: From Molecular Biology to Synthetic Biology – What's New?
Presenter – Sandra Taylor, Manchester Institute of Science & Technology

"Sandra's session was clearly a popular one, as the Charnwood Room was fully booked. Sandra gave an insight into how disciplines including molecular biology, chemistry, microbiology, and data modelling are combining to develop a new model for computational scientists, "design, build, test, and learn". The scientists use big data to design useful molecular pathways; then a combination of wet lab scientists and robots build, express, and purify these pathways. A team of chemists test the produced molecules; 3D printing allows building at nanoscale.

Sandra explained how Synthetic Biology Centres such as SYNBIOCHEM look to harness this new way of interdisciplinary working, which brings its own challenges in terms of ethics, automation, social responsibility etc. The session was very well received with some delegates' staying on to ask questions about a number of issues." – JW

Workshop 8: Defining the future of the IST
Presenter – Dr Helen Sharman, OBE (President of the Institute of Science & Technology)

"Helen's session saw over 40 technicians crammed expectantly into a conference room. "We recognise that times have changed and IST may need to change," she said, launching off the discussion. She continued, "We really do want to know what you want from the IST."

In groups, we discussed what benefits members should expect from the IST, in what areas the organisation could do more to help members and the technical community, and potential funding sources – new income streams. The noise level in the room soon rose and discussion became animated. The feedback from the groups was excellent and a lot of fantastic ideas and comments came out of the discussions. At the end of the session Helen thanked everyone for their constructive and useful input."–AC

Workshop 9: Champions for Professional registration
Presenter – John Dwyer, University of Lancaster

"The workshop was well attended and John got lots of audience interaction. John gave the background on what an IST Professional Registration Champion is, what is required of a Champion, and how to become a Champion. He explained how Champions can help foster interested in professional registration and further raise the profile of the IST. He also explained what support Champions receive from the IST. A current Champion, Suhel Miah from the University of Westminster, was invited to answer questions and interact with the audience. A lot of discussion took place, and the feedback after the workshop was very positive. John gained three more champions directly after the workshop with others showing an interest in becoming champions in the future." – JD

A summary of the conference's workshop sessions will also appear in the spring issue of The Journal.

So what did delegates think of the conference?

"Very interesting talks and workshops"

"Liked the presentations and depth of knowledge of topics covered"

"Great mix of themes very relevant in today's tech world"

"This conference is an amazing event that helps to improve skills and helps to be better technicians. It also helps you connect with other techs."

"Liked the variety of talks and the length of the day"

"Great mix of themes very relevant"

"Presenters and the talks great overall and depth of knowledge of topics was excellent"

"Great for networking"

"Wow Fantastic"

"Very focused on subject matter"

"Educational "

"Dr King very good but Prof Ojha excellent loved it to bits"

"Presentations and in-depth knowledge of topic excellent"

"Loved both speakers would have loved them to be at the event longer"

"Best keynote speakers I have heard, the enthusiasm was tangible"

"Couldn't be better very slick"

"The afternoon session was particularly impressive awesome stuff, very inspiring"

"Great subject matter for both speakers"

"Both interesting in how science is used in different ways"

"Very interesting, I would like to read more on RichardIII, the talk about space was just great – excellent speakers."

"Very good choice of speakers for multi-discipline audience"

"Professor Anu, incredible, an inspiration"

"The speakers have been great for the last 3 years but I thought these were exceptional – congrats"

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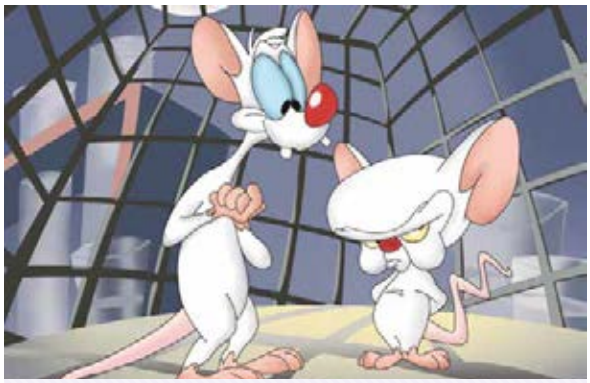
Pinky: a technician's technician

Andy Connelly

It was the decade of the first genetically modified food, of genetic sequencing, and of Dolly the sheep. A decade of hype and fear about a genetically modified future, a decade primed for a cartoon about two laboratory mice whose genes, as the theme song went, "have been spliced." Created by Tom Ruegger and Steven Spielberg, *Pinky and the Brain* featured two talking, walking, scheming white lab rodents; one short megalomaniac called Brain and his tall goofy assistant, Pinky. As a child, I loved watching the show for the ridiculous plans and bizarre catchphrases. Looking back now, I see a clever and witty social commentary, at the centre of which was the relationship between a mouse-sized scientist and his technician.



Pinky and the Brain

It is Pinky we see first in the opening credits, running on a hamster wheel attached to the side of a small cage. Pinky's whiny pseudo-Cockney accent asks a simple question, "Gee, Brain, what do you want to do tonight?" The reply comes in a voice that is "two-thirds Orson Welles and one third Vincent Price"[1], "The same thing we do every night, Pinky—try to take over the world!" Between 1995 and 1998 this exchange appeared in sixty-five madcap episodes. When the sad day arrived of *Pinky and the Brain*'s final episode, the world lost a cartoon that had so much to teach us.

From their cage in the Acme Labs Research Facility each episode starts with the ever-eloquent Brain setting out his plan for world domination. It might be as simple as becoming a mousy President of the USA, or something more complex, like stopping Big Ben at 4pm to create a perpetual tea-time that would give Brain the opportunity to take over the British Empire.[2] Simple or convoluted—and it was usually convoluted—each plan ultimately ends in failure...a failure that is often blamed on Pinky.

Presented as good-natured but feeble-minded, Pinky is often shown ruining Brain's carefully laid plans by making a mistake such as saying the wrong thing or unplugging the wrong device. Brain certainly believes Pinky is at fault and consistently victimises Pinky with snarky deadpan humour and occasional violence. He is constantly putting Pinky down with insults like, "Stop auditioning Pinky, no one is hiring village idiots anymore" and "Scientifically speaking, it's because you are a beetle headed doofus, with the intellect of a mule hoof."[3-4]. Despite the bad treatment, Pinky loves Brain; he is ever-generous, in one Halloween special even selling his soul in an attempt to get Brain the world[5].

Pinky is hyperactive – he has strange verbal tics, such as "narf", "zort", and "poit" and is constantly going off on bizarre non-sequiturs. By contrast, Brain is the archetypal mad scientist, a Napoleon Bonaparte type figure[6] who tries, over and over again, to conquer the world with completely unworkable schemes. He is miserable, lonely, and deeply frustrated. Pinky is happy, enjoys life and finds love–even if it is with a race horse called Phar Fignewton[7]. Of the two of them, over 65 episodes, it is only Pinky whose plans work; he takes over the world three times[8-10].

I have watched many episodes as part of my...ahem... research for writing this piece. I have realised two things: one is that, as a child, I only understood about 20% of the jokes. Even as an adult, I still only get about 70%. The other thing is that Pinky is neither an idiot nor feeble-minded. He is just badly managed.

Pinky does not want to take over the world himself, but he does want to help. Pinky's desire to help is never realised because he is operating in the dark. He is never properly included in the plan and so he bumps into things and makes mistakes. For example, in the Episode "Pinky POV", how was Pinky to know that turning down the music to hear Brain's instructions would ruin Brain's grunge-band-based-plan to take over the world?[11]

Pinky has skills and knowledge that Brain can only hope for. For example, in the episode, "Welcome to the Jungle", when cast into the wild, Pinky lives on

Pinky

his instincts and thrives, looking after Brain, who doesn't know what to do[12]. In the episode "All you need is Nark", Pinky uses his special form of wisdom to become a famous guru[13] More than once Pinky's knowledge of popular culture could have aided Brain's plans[14] but these are not skills that Brain recognises as helpful; in fact, he sees such knowledge as a slight, as being beneath his genius. In the episode "Pinky's Plan", for Brain's birthday, Pinky organises a surprise party and persuades various world leaders to hand their countries over to Brain with an emotional speech in which he describes Brain as his "selfless, smart, pudgy friend". Brain arrives at the party but his own insecurities lead him to assume that Pinky is plotting behind his back. The resulting scene is so unpleasant that the world leaders take a dislike to Brain, take back their countries and walk out.[8]

It is not that Brain doesn't want to involve Pinky and show him love. Brain is aware that Pinky is his only real friend. After Pinky sells his soul, Brain ends up saving Pinky because he misses him and he realised that the world wasn't worth ruling without him. Of course, Brain cannot admit this. If Brain had trusted his technician throughout it would have been a very different cartoon, and one in which Brain would, I believe, have achieved his aim of world domination.

Pinky is a technician's technician; ever-generous, selflessly trying to help the project—and Brain—succeed. It is a shame that Brain so rarely sees it.

Pinky: Egad, Brain! I wish I was as smart as you.

Brain: I wish you were as smart as a tree stump, Pinky.[15]

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Author

Andy is a technician and laboratory manager in the School of Earth and Environment at the University of Leeds. Alongside his day jobs, Andy has been writing and publishing both academic papers and popular science articles since 2007. His articles have appeared in Physics World, Physics and Chemistry Review, and on Guardian.co.uk. More recently, he has focused on practical science for his blog (**andyjconnelly.wordpress.com**) and writing about technicians, recent, historical, and fictitious.

The engineer Chas W. Cook – Part four

Alan Gall, IST Archivist

Introduction

Previous episodes have followed the progression of Chas W. Cook's engineering career up to the 1930s, at which point he established a new venture at the Royal Hotel & Bath Grounds Estate, Ashby de la Zouch. There, he and his sons ran the hotel and garage in conjunction with facilities to construct scientific equipment.

It took considerable persuasion on the part of the young Cooks to convince their father that a move to Birmingham, rather than London, would be a commercially desirable next step. The hotel went up for sale, passing into the hands of a Mr and Mrs Hutton and then to the brewers Mitchells & Butlers Ltd in 1949.

By 1937 operations had been moved to 97 Walsall Road, although an office at Putney provided the means for Chas Cook to revisit his beloved London. The emphasis was still on high-pressure/high temperature equipment and the firm remained independent until 1968. Although still a profitable company with worldwide sales, new owners had little regard for its eminent position in a niche market and closed it down. Resurrected as Chas W. Cook (MM) Ltd it survived until 1998.

Figure 1: Cricket at Ashby – the Southport tour 1929. (1) Charles William Cook (2) Albert Leslie Cook (3) J. F. L. Wood (4) J. Stone (5) R. Tetley (6) T. Wilton (7) Alfred William Cook (8) H. Sansom (9) G. Ridgway (10) P. M. Webster (11) Charles Edgar Cook (12) F. German (13) R. Dickinson (14) T. Bass (15) L. Sansom (courtesy of Ashby Hastings Cricket Club)

Figure 2: From the Ashby days, a rubber ageing apparatus (courtesy of Ted Cook)

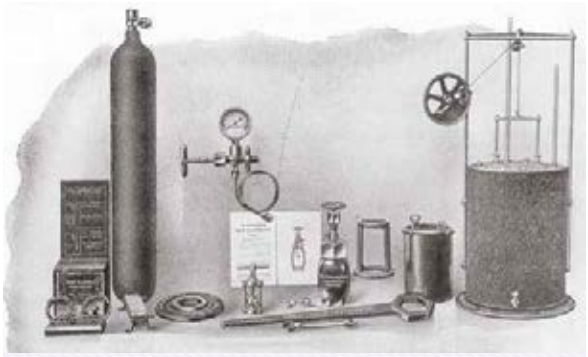


Figure 3: Mahler-Cook calorimeter with accessories, as shown in the 1929 W & J George Ltd catalogue

The move to Birmingham

Coinciding with the relocation to Birmingham, Charles Cook nominally retired and Charles Edward Cook became the governing director of newly formed Chas W. Cook & Sons Ltd. Chas adopted the role of consultant and technical advisor.

The new factory at Walsall Road went under the name of "University Works", a throwback to the days at the University of Manchester. A range of centrifuges was developed, simply called the Birmingham I, Birmingham II, Birmingham III and Birmingham IV. Model III operated up to 10,000 rpm, exerting a

precipitating force of 12,000 times gravity. They were sold directly or through agents. The same four models could be bought from Standley Belcher and Mason Ltd[1] under the model names of University I to IV. Most of the centrifuges were mounted on polished mahogany bases and reflected the Cook ethos of building sturdy, good quality equipment – if a little dated in looks.

Further refinements were made to the Mahler Cook bomb calorimeter that culminated in a patent of 1942. It found use in a variety of scientific studies such as that by Williams & Evans[2] and Raymond, Canaway and Harris.[3] Availability of the bomb was much enhanced when some of the major laboratory suppliers offered it in their catalogues, like J. W. Towers & Co Ltd who operated branches in Manchester, Liverpool, Stockton and London. Baird & Tatlock (London) Ltd and Brady & Martin Ltd at Newcastle-on-Tyne were early stockists. There were a number of new products to consider in the 1950s, such as the feasibility of making an instrument to measure the intensity of lines on Debye-Scherrer diffraction films.[4]

Figure 4: Plan of the works between Walsall Road and the River Tame, close to the present day Perry Bar Stadium, Birmingham. (A) Chas W. Cook & Sons, University Works. (B) Webshaw Manufacturing Ltd. (C) W. C. Skinner (Builders). A new factory was later built on the site of all three, for Evershaw Accessories Ltd

Figure 6: A hydraulic pump offered in 3 different pressure versions: 500 psi, 3 tons per square inch and 5 tons per square inch (courtesy of Ted Cook)

Figure 5: Cook Duplex Hydraulic Hand Compressor. Originally a design due to Joseph Petavel and developed by Chas Cook for pressures up to 5000 atmospheres (courtesy of Ted Cook)

Figure 7: A steam heated rotary autoclave (courtesy of Ted Cook)

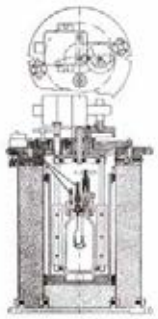


Figure 8: Internal view of the Mahler-Cook bomb calorimeter patented in 1942

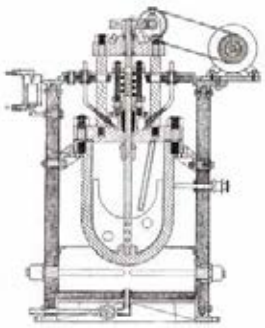


Figure 9: A six-gallon autoclave to operate at 1 ton per square inch and 200° C (courtesy of Ted Cook)

Figure 10: Cook centrifuge designated as the "Birmingham I" in the Cook catalogue and the "University I" in the Standley Belcher & Mason catalogue, 1939

Figure 11: Low-pressure catalytic hydrogenation plant (courtesy of Professor. Hans Michaels)

End of an era

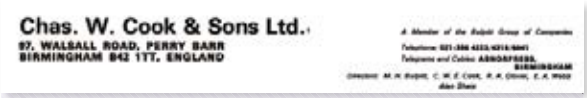
Charles William Cook died on 27th July 1945, the month that the first atomic bomb tests were carried out in the New Mexico desert and the Labour Party's Clement Attlee replaced Winston Churchill as Prime Minister. Amongst Chas Cook's cherished possessions, to be passed on, were framed pictures of Humphry Davy and Michael Faraday. Daughter Margery had already taken charge of the grand piano and majority ownership of the business resided with Charles Edgar Cook. Margery also received the largest monetary bequest and property at 429 Upper Richmond Road, London. It was Chas Cook's desire to be buried at Putney Vale Cemetery in London, with his wife Lottie. Putney Vale Cemetery is the resting place of many celebrities (see Wikipedia entry).

From pillar to post

Charles Edgar Cook (the majority shareholder) and Albert Leslie Cook sold their shares in Chas W Cook & Sons Ltd to Webshaw Manufacturing Ltd in 1968, itself part of Bulpitts (Swan Brand) Ltd since 1961. Charles Edgar's son Ted remained with the business.

The take-over led to a seemingly never-ending series of moves for employees. These were from Perry Barr to Camden Street, Camden Street to Graham Street, Graham Street back to Perry Barr, Perry Barr to Warstone Lane and, finally Warstone Lane to Halberton Street, Smethwick. All these relocations were completed over the years 1980 to 1990.

The first change of address came when Cooks moved to the main Bulpitt factory – the Albion Works, spread over several streets in Birmingham. Bulpitt's subsidiary, Tenby Industries, had factories at Graham Street and Warstone Lane. Both locations were used, but in between was a return to the now enlarged premises at Perry Barr. The final move combined Chas W. Cook & Sons, which still retaining its separate identity, with the toolroom at Tenby Industries' works on Halberton Street in Smethwick.


Chas. W. Cook & Sons Ltd.
97, WALSALL ROAD, PERRY BARR
BIRMINGHAM B42 1TT, ENGLAND

A letterhead post 1968 but before the move to Camden Street (Albion Works)

A more modern looking selection from the 1980s when under the control of Tenby Industries (courtesy of Mike Allsop)


CHAS W. COOK & SONS

The second Birmingham home

Mike Allsop witnessed the final days of Chas W. Cook & Sons.

Albion Works was the home of Bulpit & Sons based in Camden Street, Birmingham. They were predominantly metal workers producing metal spinning for missile warheads, trays for forming Cadbury's chocolate bars, and the Swan brand of saucepans, kettles etc. They also owned various subsidiaries, including Tenby Electrical Accessories, where I was employed, and at that time included Chas W. Cook. Early in 1971, BSR (Birmingham Sound Reproducers), manufacturers of record players, acquired the group.

Very little changed until the mid-eighties when Tenby and some of the group's engineering activities, that were very profitable, found themselves supporting a "lame duck" parent company. Following flotation, Tenby Industries was formed retaining five of the successful engineering divisions: Tenby Electrical Accessories, Fraser & Glass, BKB Electric Motors, Bulpitt Engineering, and Chas W. Cook & Sons.

[French manufacturer Moulinex acquired the Swan houseware section including the Teasmade & Swan trademarks in 1988/9.]

Emess Lighting plc acquired Tenby Industries some two years later. At this time I was involved with special projects for the group who were going through several changes due to an ongoing recession. It was in this capacity that I was requested to transfer a small engineering section known in the group as Cooks from Eversures [a BSR subsidiary] at Perry Bar, Birmingham. Evershaws were allied to the automotive industry and, I think, subject to a management buyout.

This was the first time I had met Dr Alan Sharp [director of Chas W. Cook & Sons] and Edward Cook [Charles William Edward (Ted) Cook]. The section comprised of some basic but antiquated tool room machinery and was transferred to premises in Grahame Street, Birmingham that specialised in pressings for the Tenby range of products. It was on this site that I shared an office with Dr Sharp and although we were both often "off site" the few times we were together was either talking sailing or strolling around the Science Museum a short distance away.

Late in 1989 it was decided to sell Grahame Street for development and the works transferred to ex-Bulpit premises in Halberton Street, on the boundaries of Smethwick and Birmingham. It was about this time that the then financial director Barrie Channon decided, I believe, to close the Cooks division as it did not form part of our core product range. I don't believe that there was any attempt made to sell or transfer the business. I recall at the time, it was stated that this move was unforgivable as they were the only manufacturers of these products in the UK.

Chas W. Cook (MM) Ltd

The end of the story? No, not quite. The Mining Journal of 12th April 1991 reported on one final attempt to continue the business of Chas Cook: "In a recent development, a group of engineers and academics have taken over the interests of Chas W. Cook & Sons, to both maintain and extend the existing range." The contact address was given as Magnet House, 251 Alcester Road South, Kings Heath, Birmingham.

Behind this effort were Dr Terence Veasey (the academic), Stephen Ralley, Ivan Ratnam, Geoff Worley and Cliff Walker. Ralley and Ratnam held the controlling interest through their partnership Ratnam Ralley Ltd. Geoff Worley had formed Master Magnets Ltd in 1977, specialists in magnetic separation, and most of the others in the group were connected with Master Magnets. Metallurgical testing represented the area of common interest since Chas W. Cook & Sons had developed an international reputation in this field.

Although the resurrected company received its certificate of incorporation in January of 1991, operations did not commence until 1st March 1993. The first trading period showed a small loss on a turnover of £12,265 and the second year, a larger one. Year three brought the firm into profit.

Founder member Ivan Sebanaser Ratnam died 13th September 1994 at the age of 59 and new directors were taken on, including Ronald Bayly, a director of Transmag UK Ltd (manufacturers of high-voltage transformers). The years 1996 and 1997 showed profits, but in 1998 the company applied to be struck of the register at Companies House, dissolving Chas W. Cook (MM) Ltd.

Charles William Cook

What about the man himself? Charles Cook's daughter Margery gave some insight into his character before her death at the age of 104. Chas followed Manchester United, attending matches when he still lived in the city. As we have seen, he also had a fondness for cricket. Although motorcar mechanics fascinated Chas, he didn't drive, but enjoyed being driven on outings (the family car at Ashby de la Zouch was an open-topped Ford). He liked to drink in moderation – the occasional whisky & soda or a beer, only consumed at home. He smoked either a cigar or a pipe as the mood took him. The move to Birmingham saddened him. At Ashby he loved the expanse of land behind the hotel, with its tennis court, bowling green, cricket and football pitch. Chas Cook cherished the memories of his days at the Royal Institution and the University of Manchester, often speaking about the great men of science he had met along the way. In his working life he was energetic and ambitious, always seeking new experiences. Until late in life he began his day early at the drawing board, sketching out new designs. In certain matters he was a man of fixed habits, a little bit boastful, and forever a Londoner.

In the interview with Chas Cook that featured in the *Town & Country News* of 13th July 1934 there is mention of his involvement with large undertakings. Amongst them were projects of unspecified nature for the Blackwall Tunnel (London), Richmond Lock and Weir, Woolwich Free Ferry, Southern Railway workshops and Calico Printers, France. A glimpse is also given of war work conducted while at the University of Manchester: " ...the design and production of depth charges, hydrophones, torpedo work, precision gauges for shells, aircraft engine work and the many special jigs and tools of precision for the mass production of parts by female labour."[5] Clearly, there is much more to be discovered about this talented engineer.

Acknowledgements

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Matt Longley, chairman of the Ashby Hastings Cricket Club.
Professor Hans Michels, Imperial College London.

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Top tips for managers on how to recruit an apprentice technician

Jonathan Cresswell

Thanks to an apprenticeship, Alan's helping people with lifelong medical conditions. (Credit: Technicians Make it Happen)

Apprentices at universities are a valued addition to existing technical teams, and enhance skills to meet existing and future skills gaps. On successful completion of an apprenticeship, the apprentice will have gained invaluable skills and qualifications, and most importantly on the job experience.

The University of Exeter Apprenticeship strategy will boost workforce capability, through "growing our own" talent from a variety of entry routes, and enhancing skills of our existing staff, to meet our existing and future skills gaps. As we are a registered training provider, there will also be opportunities through delivering of our own apprenticeship courses.

Apprenticeships at entry-level, higher, and degree level will be open to new and existing staff as an opportunity to learn new skills, enhance existing skills, or retrain to follow a new career direction.

The introduction of the Apprenticeship Levy on 6 Apr 2017 gives universities the opportunity to tap into a digital account to pay for the apprentices training through a registered training provider.

Technical line managers and hiring managers can use the following points to help them embed apprentices into their service.

Role identification

Apprenticeships need to be embedded within an institutions workforce planning. This will ensure that they have the ability to develop their careers.

There are a number of ways you could develop apprenticeship roles in your staffing plan:

1. Assess whether planned roles, already in business plans, could be offered as apprenticeships.

2. When starting the recruitment process, consider whether the role you are looking to recruit could be filled by an apprentice.

3. Offering current staff enhanced opportunities to retrain and upskill by targeting apprenticeships at key capability gaps.

Type and level of apprenticeship

The apprenticeship should be aligned to the type of employment/role that you are looking to fill. If there is a business need for a Laboratory Technician then you should be looking at a Laboratory Technician/Scientist apprenticeship, or if you are looking for a mechanical engineer then you should recruit an apprentice on a Mechanical Engineering Apprenticeship. There is a really useful A-Z of apprenticeships and a find apprenticeship training guide on the government website that can help you find the right training.

You will need to decide on the most suitable level for the apprenticeship – this should broadly align with the role and the responsibilities you need the apprentice to have. These could be school leavers with GCSEs, College leavers with A-Levels in the relevant subject areas, or even graduates.

Find the training provider who can deliver the apprenticeship

There are a number of training providers that may be able to deliver the training, qualifications and assessments to your new apprentice. A list of approved training providers has been published to help you decide on the right one.

Apprenticeship training lasts between 1-5 years depending on the type and level of training –training is typically 12-24 months.

Agree the salary for the role

This will vary between institutions and organisations, however, it is my belief that apprentices should be paid a fair wage aligned with the job they are doing. All apprentices must be paid at least the government minimum wage. This is currently £3.50 per hour for an apprentice, and this rises to meet the minimum wage for the specific age group.

Advertise the apprenticeship

All new apprenticeship roles should be raised through your recruitment system as you would for any new staff member.

Apprentice vacancy templates differ from normal institutional format as they are written to enable them to be advertised through the Government's "get in go far" website. They can also be advertised through your training provider and your organisations website.

The job description needs to be written in plain English and any abbreviations should be written out in full so that people outside our organization are able to understand the role we are advertising.

You should also try to avoid or reduce any university/ business jargon. The job description should enable the applicant to understand what the role is and what you will be requiring them to do.

Interviews and selection process

Some training providers can shortlist candidates and conduct an initial assessment for you. This could help ensure that all apprenticeship candidates meet the training provider's eligibility criteria, and gives you a choice of high quality candidates. Your organisation would then conduct interviews for the candidates that make it through the initial testing.

The hired apprentice must sign an apprenticeship agreement and commitment statement as part of a formal contract. This will detail the duration of the apprenticeship, the training, working conditions and the qualifications they are working towards.

Employment start and inductions

An effective induction process is essential for all new members of staff, and this is no different for an apprentice as they are an employee first and foremost.

Your inductions should assist the apprentice to perform effectively in their job role and within their work environment as soon as possible.

It is very import to ensure that a thorough local induction is carried out for the apprentice in their work area. This must also include health and safety information and guidance specific to their work. You should issue them with any Personal Protective Equipment (PPE) before they start working on anything that requires its use.

Mentoring and support

The apprentice's line manager, or a nominated colleague, should be assigned to mentor/buddy the apprentice. The mentor is there to offer support and to use their knowledge, skills and connections to help the apprentice in their new role and help them develop.

Mentors should help the apprentice become more self-aware and allow them to take responsibility for solving their own problems.

Mentors may require some training around coaching and mentoring to help them in their role.

Apprentices will generally be supported by skills assessors/tutors from training providers who will visit the apprentice on site and provide support during their time with them on off-the-job training.

Some advice on how to make your apprenticeship working relationship work:

1. Ensure the apprentice has a mentor. This will help the apprentice to settle into their new surroundings and will enable them to quickly pick up what to do.

2. Set expectations discussing University organisational values and workplace etiquette. It is important to set your expectations from the very start of their employment e.g.:

    - When they can/cannot use their personal phone at work.
    - Being punctual and ready to start work on time (not walking through the door at their start time still wearing their coat etc.). Do not be late, but if you know you might be call ahead.
    - Ensure they are dressed appropriately for the work they are doing.
    - No eating in workshops or labs, and encourage them to take their lunch break away from their workplace.
    - Keep the workplace clean and tidy – and tidy up after them.
    - Be polite, respectful and professional.
    - Never walk past a mistake – report it.
    - Remind apprentices to always do their best, someone is watching.
    - Apprentices should champion Apprenticeships.

3. Schedule regular 1:1 meetings/catch-ups to review progress and development of the apprentice in their work and with their training.

4. Include apprentices in team tasks, activities and meeting s to help them feel part of your team.

5. Set their PDR objectives and targets at the start. Do not forget to make them Specific, Measurable, Achievable, Realistic and Time bound (SMART).

6. Encourage the apprentice to use their new and existing skills to contribute directly to your business needs.

7. Keep apprentices motivated and interested by challenging them with new tasks to consolidate their skills.

8. Say thank you often and use the employer recognition schemes if you have one – give praise where praise is due.

9. Support their apprenticeship training. You may be able to give them work that they can use towards projects or evidence for their skills assessor.

10. Ensure that they are supported by ensuring the apprentice has 20% of their time for off-the-job training.

11. Encourage them to join a professional body as early as possible to start them on their CPD journey and work towards professional registration.

12. Regularly communicate with the apprentice and their training provider to check they are on track and address any issues/concerns that they may have.

13. Know when the apprentice has their college/training day, and get involved with visits from their skills assessor/tutor.

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Jonathan served for 17 years as a Royal Marines Commando electronics specialist, before spending a further 2 years as a commissioned logistics officer in the Royal Navy. In 2012 he joined the University of Exeter where he managed capital infrastructure projects, led technical services teams and worked on the technical services transformation project. Technical Services was formed on 1st July 2015 and Jonathan took on the role of Deputy Head of Technical Services. Jonathan champions professional registration through the Science Council, and the Institute of Science and Technology, and worked with HEaTED to embed the CATTS framework for Exeter's technical staff. Jonathan is now leading the University strategy for apprenticeships.

Isolation, molecular characterisation, and probiotic potential of lactic acid bacteria from gastrointestinal tract of cat fish (Clarias gariepinus)

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Abstract

This study aimed to isolate, characterise, and screen lactic acid bacteria from gastrointestinal tract of fresh water cat fish (*Clarias gariepinus*) for probiotic potentials. Physicochemical quality of culture water was noted. Proximate analysis of the samples was investigated while gut contents of the samples was analysed for presence of lactic acid bacteria (LAB). In-vitro assays were carried out to screen probiotic candidates among the isolates based on enzyme production and other probiotic activities. Sixty-two lactic acid bacteria were isolated and identified to be *Bacillus* spp, *Micrococcus* spp, *Lactobacillus bulgaricus*, *L. casei, L. rhamnosus, L. acidophilus, L. plantarum, L. brevis, L. fermemtum* and *L. viridescense* based on biochemical and molecular tests. Nine isolates had the ability to hydrolyze protein and starch. Further in-vitro tests showed that *L. acidophilus, L. rhamnosus, L. viridescens, Lactobacillus* sp were able to tolerate lower pH than *L. bulgaricus, L. brevis*, and *Bacillus* sp. *L. fermentum* was unable to grow at pH 3. Out of the nine isolates, 5 survived different concentration of sodium chloride (0.5% and 1%) while the remaining 4 had partial growth. All isolates when tested on 10 different types of antibiotics (Pefloxacin, Gentamycin, Ampiclox) appeared to have average resistance and susceptibility to the antibiotics. Using the agar well diffusion method, the probiotic candidates, *L. acidophilus, L. rhamnosus, Lactobacillus* sp, and *L. fermentum* showed antagonism against the indicator organism (*Staphylococcus aureus*). The result obtained in this study demonstrated the capability of the selected probiotic candidates to inhibit the growth of *S. aureus* and survival of the candidates was satisfactory at pH 3.0 and at different concentration of NaCl which indicated that the selected bacteria would be suitable as probiotics.

Introduction

Over the last decade, aquaculture has gained momentum a viable method to produce sea food. The National Oceanic and Atmospheric Administration (NOAA), the leading agency on aquaculture, has dedicated federal guidance and financial aid in order to develop aquaculture regulation, policy and physical systems. It defines aquaculture as "the propagation and rearing of aquatic organisms in controlled or selected aquatic environments for any commercial, recreational or public purposes". However, fish culture is currently suffering from serious losses due to infectious diseases (Pandiyan *et al*., 2013). When faced with disease problems, the common response has been to turn to antimicrobial drugs; the use of such products has obvious benefits to treat animals infected by bacterial disease.

Antimicrobial drugs are used as either preventive or for growth enhancement (Kesarcodi-Watson *et al*., 2007). Sometimes the antibiotics are used to treat diseases but more commonly antibiotics are used to prevent diseases by treating the water or feed before disease occurs. The overuse of antimicrobial agents can result in increased emergence of resistant strains of bacterial pathogens that become more difficult to treat with standard antibiotics approved for use in aquaculture. The risk is not just the potential loss to the farmer. The emergence of resistant strains on aquaculture farms could pose a risk to human health (Kesarcodi-Watson *et al*., 2007) causing transfer of plasmids coding for resistance to a certain antibiotic to bacterial pathogen of man.

Due to concerns about residues in animal products and development of bacterial resistance to antibiotics the potential exists for the implementation of a complete ban of the use of antibiotics in animal feed, and the development of alternatives to

antibiotics is receiving considerable attention. In this context, microbial intervention can play a vital role in aquaculture production and these provide an environmentally friendly aquaculture, an effective and broad spectrum and also greater nonspecific disease protection. This study aimed to isolate and investigate probiotic properties of lactic acid bacteria isolated from cat fish.

Materials and methods

Sample collection

Three fish farms, Akatugba fish farm, Ijegun – Parapha fish farm, Ikorodu - and Odogunyan fish farm, Ikorodu – were visited and live catfish samples were collected from each. The water quality parameters monitored were: temperature, conductivity, pH, dissolved oxygen (DO), salinity, and ammonia. The fish species were identified by a zoologist at the Federal College of Fisheries and Marine Technology as *Clarias gariepinus*. For testing, one gram of the gut of each fish was homogenised with 9ml of sterile distilled water. The tubes were spun at 2,000rpm for 10mins. Thereafter, 1ml of the supernatant liquor was taken and serially diluted in sterile distilled water in test-tubes to 10^{-2},10^{-3},10^{-4},10^{-5}, and 10^{-6} dilution.

Isolation and biochemical characterisation

Nutrient agar (Liofilchem diagnostic, Italy), De Man Rogosa Sharpe (MRS) agar (LAB M, United Kingdom), and Tryptone Soy Agar (TSA) (Oxoid Ltd, England) were used for bacteria isolation following the manufacturer's instructions. Colonies were randomly selected and subjected to Gram staining and biochemical tests according to Cheesbrough (2000).

Molecular characterisation

Extraction of genomic DNA and PCR amplification of 16S rRNA gene

Extraction of Genomic DNA was done from overnight culture of isolates with ZR Fungal/Bacterial DNA MiniPrep (Zymo Research Corp) according to the manufacturer's instruction manual. Extracted DNA was then amplified. Briefly, PCR reaction mixtures of 25µl containing 2.5µl 10x Assay buffer, 2.5 µl (2.5 picomoles) Reverse primer (- TCCGTAGGTGAACCTGCGG), 2.5 µl (2.5 picomoles) Forward primer (ITS4- TCCTCCGCTTATTGATATGC), 1µl 5x Master mix, 1µl Tag polymerase (3 units/µl) and 5.0µl genomic DNA was prepared. Amplified PCR product was sequenced and compared with those in GenBank (NCBI).

Proximate analysis

Proximate analysis of the muscles was carried out according to standard methods of the Association of Official Analytical Chemists (AOAC, 1994).

In-vitro screening and selection of probiotic bacteria candidate

Proteolytic test

Each probiotic bacteria isolates were tested for proteolytic properties through the hydrolysis test of casein. The samples were grown on Nutrient agar + 2% skimmed milk and incubated at 37°C for 24-48 hours. Proteolytic property was observed by measuring the clear zone around the colony after incubation.

Amylolytic test

Each probiotic bacteria isolates were tested for amylolytic properties through the hydrolysis test of starch. The samples were grown on Nutrient agar + 2% starch and incubated at 37°C for 24 – 48 hours. Amylolytic property was observed by measuring the clear zone around the colony after incubation by adding 1% Grams iodine. All isolates which have at least one digestive enzymatic property was subjected for the subsequent tests.

pH tolerance

Acid tolerance of the selected bacteria was investigated. Nutrient agar was supplemented with 1% hydrochloric acid. The nutrient agar was autoclaved at 121°C for 15 minutes, it was dispensed into petri dishes and after cooling, the bacteria was inoculated and incubated at 37°C for 24 hours.

Growth at different salt concentration

Growth rate of the bacteria at different sodium chloride concentrations was observed by adding 0, 0.5, and 1% NaCl. The Nutrient agar plates containing different levels of NaCl was inoculated with selected probiotic strains and incubated at 37°C for 24 hours.

Antagonistic activity of isolates and antibiotic susceptibility test

The pathogenic bacterium used was *Staphylococcus aureus* that are pathogenic to catfish. The fresh culture of probiotics bacteria candidates added in 0.1ml diluents in 0.9ml physiological solution to obtain a suspension of probiotic candidates. Sterile filter paper was cut to make disc and was sterilized. 0.1ml of the pathogen solution was spread over nutrient agar and allowed to dry for 15 minutes. The sterile disc was impregnated with the probiotic candidates and placed on the petri dishes inoculated with the pathogen. The petri dishes were incubated at 37°C for 24 hours. Antagonistic activity was observed by measuring the inhibition zone diameter around the discs. The selected probiotic bacteria were subjected to antibiotic susceptibility profile tests.
The nutrient agar was inoculated with bacteria by spread method and the antibiotic disc was placed on the agar and incubated at 37°C for 24 hours. Antibiotic

susceptibility was observed by measuring the inhibition zone diameter.

Results and discussion

In this study, potential probiotics were isolated from the gut of African Catfish *C. gariepinus*. These parameters are dependent on various factors.

Parameters	Site 1	Site 2	Site 3
pH	6.80	7.70	8.70
Temperature (°C)	31.2	28.7	29.5
DO (mg/l)	0.29	0.38	0.31
Salinity (psu)	4.30	0.75	7.99
Conductivity (ms/cm-4)	0.08	0.15	0.14
Total dissolve solid (g/l)	3.90	0.75	6.93
COD (mg/l)	0.83	0.96	0.77
Ammonium (mg/l)	3.47	1.56	4.82

Table 1: ***Physiochemical properties of water samples***

The result for Table1 shows the physiochemical analysis of the water samples obtained from the three sites A, B and C. The most influential parameter is temperature. It determines to a large aspect other parameters. It also controls the rate of all chemical reactions. The temperature range of the three sites was between 29.5°C – 31.2°C. This is in line with the recommended parameter for temperature of water for pond use as stated by Onuoha and Elezuo (2013). The pH of the three sites varied from 6.8 to 8.7. Site 1 and Site 2 were in the neutral range while Site 3 was slightly alkaline. The pH value conforms to the recommended pH value given by Onuoha and Elezuo (2013) which was stated to be within 6.5 – 9.0.

Samples	Ash (%)	Moisture content	Lipid	Protein
S1	1.27	75.32	1.28	19.95
S2	1.20	74.69	1.18	19.47
S3	1.23	76.26	1.23	19.59
S4	1.23	76.71	1.23	19.64
S5	1.19	74.77	1.20	19.55
S6	1.19	75.57	1.19	19.60
S7	1.27	75.67	1.26	19.57
S8	1.16	76.00	1.18	19.49
S9	1.22	75.57	1.25	19.23
S10	1.22	74.63	1.23	19.69
S11	1.33	72.15	1.30	20.56
S12	1.22	76.56	1.26	18.68
S13	1.17	79.74	1.20	18.99
S14	1.09	74.38	1.12	18.70

Table 2: ***Proximate analysis of fish samples***

The result of Table 2 shows the proximate analysis of the fish samples. Fishes with lipid content below 5% are considered lean (Ackman, 2005). The analysis shows that C. gariepinus contains an average of 1.3% and indicates C. gariepinus is a lean fish. The result also agrees with Ackman (2005) who stated that the protein constituent in the muscles of fresh fish lies between 15% - 20%.

Isolates	Gram reaction	Catalase	Oxidase	Indole	Motility	Methyl Red test	H^{2S}	VP	Citrate	Sugar							Suspected Organism
										M	Mn	F	G	SU	SO	L	
1, 6, 8, 9, 34, 35, 47, 48	+ Short rod	-	-	-	-	+	-	+	+	+	-	+	+	+	-	+	*Lactobacillus acidophilus*
5,32,33, 38	+ Short rod	-	-	-	-	+	-	+	-	+	+	+	+	-	+	+	*Lactobacillus bulgaricus*
21, 26, 27, 28, 31, 45, 46	+ Very Short rod	-	-	-	-	+	-	+	+	+	+	+	+	+	-	+	*Lactobacillus rhamnosus*
11, 23, 25	+ Thin rod	+	+	+	-	+	-	+	-	-	+	+	+	-	+	+	*Lactobacillus brevis*
12,16, 18, 22, 29, 24, 37, 49	+ Cocci	+	+	+	-	-	-	+	+	+	+	+	+	+	+	+	*Micrococcus* spp
2, 3, 4, 7,15, 50, 51,52, 53, 54, 55,56, 59, 60, 61	+ Short rod in chain	+	+	-	-	+	-	+	+	+	+	+	+	+	+	-	*Bacillus* spp
13, 14,19, 20, 57, 58	+ Rod	+	-	+	-	+	-	+	+	+	-	-	-	-	-	-	*Lactobacillus viridescense*
10, 17, 30, 43	+ Short rod in chain	+	+	-	-	+	-	+	+	+	+	+	+	+	+	+	*Lactobacillus casei*
36, 39, 40, 41, 42, 44, 62	+ Rod	-	-	+	-	+	-	+	+	+	+	+	+	+	-	+	*Lactobacillus fermemtum*

Table 3: ***Biochemical characterisation***

KEY: (+) =Positive, (-) =Negative, M= Maltose, Mn= Mannitol, F= Fructose, G= Galactose, Su= Sucrose, So= Sorbitol, L= Lactose

Table 3 shows a total of 62 organisms were isolated from the catfish, and based on the biochemical reaction they were grouped into the genera *Lactobacillus, Micrococcus* and *Bacillus*. When the sugar utilisation patterns were compared with those given for Lactobacillus species in the Bergey's Manual of Determinative Bacteriology, the isolates were tentatively identified as *Bacillus* spp, *Micrococcus* spp, *L. bulgaricus, L. rhamnosus, L. acidophilus, L. plantarum, L. brevis, L. fermemtum* and *L. viridescense*. Molecular characterisation, proteolytic and amylolytic properties of selected isolates are shown in Table 4.

Isolates	Proteolysis	Amylolysis
Lactobacillus acidophilus	+++	+++
Lactobacillus bulgaricus	++	+
Lactobacillus rhamnosus	++	++
Lactobacillus brevis	+++	++
Lactobacillus plantarum	+++	+
Bacillus sp	+	+++
Lactobacillus viridescens	++	+++
Lactobacillus sp	++	++
Lactobacillus fermentum	++	+

Table 4: Proteolytic and amylolytic activity

The in-vitro assays were carried out to screen for potential probiotic bacteria, and selected candidates were based on several characteristics such as digestive enzyme production (protease and amylase), pH tolerance, Growth at different NaCl concentration, antibiotics susceptibility test, and antagonistic activity against an indicator organism. Out of 9 isolates, *L. acidophilus*, *L. brevis*, *L. plantarum* showed the highest zone of inhibition with *L. bulgaricus, L. rhamnosus, Lactobacillus* sp, *L. fermentum* showing little zone of inhibition for proteolytic and for amylolytic. *Lactobacillus acidophilus, Bacillus* sp and *L. viridescens* showed the highest zone of inhibition for amylolytic properties. The presence of a clear zone produced by the probiotic bacteria candidates in the test of protein and starch hydrolysis shows that the bacteria are able to break down macromolecule as a source of energy. *L. acidophilus, L. rhamnosus, L. viridescens, Lactobacillus* sp were able to survive the acidic condition of the medium while *L. bulgaricus, L. brevis, L. fermentum, Bacillus* sp were not able to grow. *L. plantarum* showed partial growth. The pH tolerance of isolates reflects the probiotic bacteria ability to survive in the stomach acidic stomach conditions. This supports the work of Alkameh *et al.*, 2014 who screened for probiotic qualities in *Enterococcus feacalis*.

S/N	Probiotic Candidates	0.5%	1%
1	*Lactobacillus acidophilus*	+++	+++
2	*Lactobacillus bulgaricus*	++	-
3	*Lactobacillus rhamnosus*	+++	+++
4	*Lactobacilllus brevis*	+++	+++
5	*Lactobacillus plantarum*	++	++
6	*Bacillus* sp	+++	+++
7	*Lactobacillus viridescens*	++	-
8	*Lactobacillus* sp	++	++
9	*Lactobacillus fermentum*	+++	+++

Table 5: Growth at Different NaCl Concentration
Note: +++ – Highest growth, ++ – Moderate growth, + – Slight growth, - – No growth

Table 5 shows the growth at different sodium chloride concentrations (0.5% and 1%). *L. acidophilus, L. rhamnosus, L. brevis, Bacillus* sp, *L. fermentum* had the highest viability (+++) in the different concentration of sodium chloride while *L. bulgaricus and L. viridescens* had minimal growth at 0.5% sodium chloride and no growth at 1% sodium chloride, *L. plantarum* and *Lactobacillus* sp. This supports the work of Nascimento-vieira *et al.*, 2013. The isolates showing more growth (+++) can be said to be highly tolerant, while isolates with minimal growth (++) are moderately tolerant. Susceptibility test on the isolates

Isolates	PEF	CN	APX	Z	AM	R	CPX	S	SXT	E
Lactobacillus acidophilus	+	-	-	-	-	++	+++	++	-	-
Lactobacillus bulgaricus	+++	++	+	-	-	-	+++	++	-	++
Lactobacillus rhamnosus	+++	-	-	-	-	-	+++	+	-	-
Lactobacillus brevis	++	-	-	-	-	+	+++	+	-	-
Lactobacillus plantarum	+++	++	+	-	-	-	+++	++	-	-
Bacillus sp.	+	+	-	-	-	-	++	+	-	-
Lactobacillus viridescens	++	++	++	++	++	++	++	++	++	++
Lactobacillus sp.	+++	-	-	-	-	-	+++	-	-	-
Lactobacillus fermentum	++	+	-	-	-	+++	+	-	-	-

Table 6: Antibiotic susceptibility of the probiotic candidates
+++ - Highly susceptible, ++ - Moderately susceptible, + - susceptible, - resistant
PEF - Pefloxacin, CN - Gentamycin, APX - Ampiclox, Z - Zinnacet, AM -Amoxacillin R -Rocephin, CPX - Ciproflaxacin, SXT - Septrin, S - Streptomycin, E - Erythromycin

revealed that *L. viridescens* was susceptible to all the antibiotics used. *L. acidophilus* was susceptible to pefloxacin, ciproflaxacin and resistant to gentamycin, ampiclox, zinnacet, amoxacillin,rocephin,septrin and erythromycin. *L. bulgaricus* were susceptibile to pefloxacin, ciproflaxacin, gentamycin and erythromycin with exception of ampiclox and strptomycin respectively. All isolates showed high sensitivity to ciproflaxacin and pefloxacin, and moderate sensitivity to streptomycin and gentamycin. Resistance to zinnacet, ampiclox, amoxicillin occurs for most of the probiotic candidates as shown in Table 6.

Antagonist activity of the probiotic candidates revealed that isolates had inhibitory effects on the pathogenic bacteria *S. aureus* with *L. bulgaricus, L. brevis* and *L. rhamnosus* showing strong inhibition to the growth of the pathogen, as indicated in Table 7.

In conclusion, probiotic lactic acid bacteria were isolated from catfish and can be used in aquaculture in place of antibiotics.

Isolates	Zone of inhibition (mm)
Lactobacillus acidophilus	15
Lactobacillus bulgaricus	14
Lactobacillus rhamnosus	20
Lactobacillus brevis	-
Lactobacillus plantarum	15
Bacillus sp	15
Lactobacillus viridescens	-
Lactobacillus sp	25
Lactobacillus fermentum	25

Table 7: Antagonistic activity against indicator organism

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Denis Papin – a technician under pressure

Andy Connelly

The recent announcement of the 2nd annual Papin Awards for technicians makes now a good time to talk about Denis Papin, who he was and why it is so appropriate that his name is used for an awards series celebrating technicians.

Denis Papin

Denis Papin, a Frenchman, entered British scientific history while fleeing religious persecution. He was a brilliant engineer, inventor, and technician who made major contributions to 17th century science, only for his name to be lost from the pages of the history books.

Denis Papin was born into a family of Huguenots in the Loire Valley in 1647[1]. The Huguenots were a group of Protestants persecuted in 16th and 17th Century Catholic France. Although officially protected, Louis XIV took every opportunity to force Huguenots to convert to Catholicism.

By the age of six, Papin was living with his uncle and going to school in Saumur, a hundred miles from his parents' home. It was a Protestant school where, on top of his normal classes, he learnt philosophy, logic, and the physical sciences. Papin's particular love was for mathematics. However, after seeing famine hit the countryside when he was 15, his desire to help people overcame his passion and he followed his uncle and grandfather into medicine[2]. After eight years spent studying at the University of Angers, he had a low opinion of both the teaching and of his fellow students but decided to finish his studies. Heading into his final exams, he encountered some difficulties. Although he was born into a noble family, he could not afford his medical exam fees and had to pay the debt off by working as a doctor in the local area[3].

Papin was desperate to get away from Angers. He had also come to realise that medicine was no substitute for mathematics and engineering. To follow his dream Papin moved to Paris, but in 1670 he was still working as a doctor. At a scholarly group, an early version of the French Academy of Sciences, Papin met the Dutch mathematician and scientist (and fellow Protestant) Christiaan Huygens. Huygens took Papin under his wing and, realising that Papin could not support himself financially, gave him a job as his assistant working on the newly invented air pump.

The air pump could be described as the 17th century equivalent of a synchrotron light source. Air pumps were at the cutting edge of science, but they were expensive and few in number. The experimental results they produced inspired great scientific controversy among western European scientists on diverse topics including pressure, respiration, and atomic theory. Papin's four years working under Huygens's guidance resulted in a book, "Nouvelles Expériences du Vuide" (New Experiments about the Vacuum). It was published in 1674 under Papin's name alongside five papers in the Royal Society's journal describing their work together[4].

Despite their success, their collaboration was short-lived, sparking a pattern of success followed by pain that would dictate Papin's life. In 1675, Huygens was forced to return to The Hague due to illness and Papin leaves Paris for London. It is not exactly clear why Papin left Paris, but as a still-marginalised Huguenot he may well have struggled to find further work. With no income, he would have been forced to leave. He chose to travel to England, possibly drawn by the presence of Robert Boyle there.

Robert Boyle was the son of the 1st Earl of Cork and one of the richest men in the British Isles. He came to science late in life but rapidly became one of the biggest scientific names of the time. His was a practical, experimental, approach to science that suited Papin's inventive skills. More importantly, Boyle had worked with his own air pump and had published the results of his experiments[5].

Arriving in London, clutching a very complimentary letter of introduction from Huygens, Papin needed a job. Initially, he took work as a tutor to make ends meet.

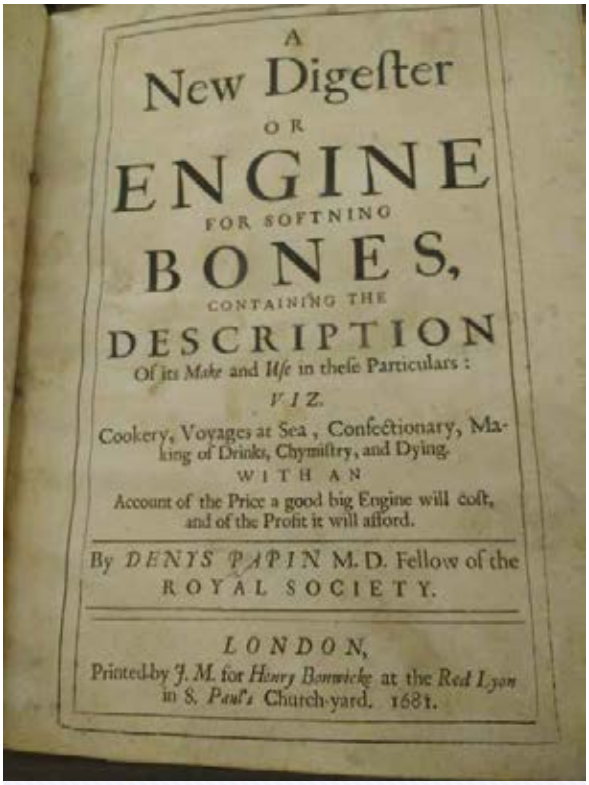
Eventually, he made contact with Boyle and offered both his own services and the use of an improved air pump which he had invented while working with Huygens. It is at this point that Papin enters the history of British science, though he would fast disappear into the shadow of first Boyle, later Hooke, and then Newton.

From July 1676 to February 1679 Papin worked for Boyle, carrying out experiments in a variety of fields, though most significantly with the air pump. It was a difficult time in Boyle's life as he was suffering from various illnesses including a long-term eye condition that made reading difficult and a painful stone[6]. Papin was different to the other technicians working in Boyle's laboratory; he was employed to work under Boyle's guidance but Boyle's illness meant that he had a lot of freedom.

This freedom might lead one to interpret Papin's relationship with Boyle as one of colleagues, with Papin as an early version of the modern day post-doctoral researcher. However, the societal situation at the time meant that Papin's status was that of servant, not a colleague[8]. When their work together was published in 1674, it appeared under Boyle's name alone[7]. And although Papin is named as the experimentalist and inventor of some of the equipment, Boyle claimed that "I myself was always present… to observe whether all things were done according to my mind." Given his health problems, this is doubtful.

Papin was portrayed as a technician, given some freedom to follow his own ideas but principally working under Boyle's control. In fact, the only experiments Boyle does not take credit for (and is, in fact, slightly dismissive of) were those experiments concerning something Papin was passionate about: the "Preservation of Fruits and of Flesh in Liquors"[7].

Somehow, the ever-inventive Papin seems to have found time alongside his work for Boyle to work on his own food-related invention. In 1679, Papin demonstrated the first pressure cooker at the Royal Society and published a book on the subject: "A New Digester or Engine for softening bones."[9] It was an intensely practical book with detailed experiments and explanations of how to cook meat and fish. Although Papin's immediate motive was, as he wrote to Huygens, "to relieve poverty, and to get wholesome and agreeable foods from things that we ordinarily reject as useless," his digester was also a major advance in an area of science that was to become his greatest tragedy, the steam engine. Crucially, Papin had invented the pressure relief valve.


A
New Digester
OR
ENGINE
FOR SOFTNING
BONES,
CONTAINING THE
DESCRIPTION
Of its *Make* and *Use* in these Particulars:
VIZ.
Cookery, Voyages at Sea, Confectionary, Making of Drinks, Chymistry, and Dying.
WITH AN
Account of the Price a good big Engine will cost, and of the Profit it will afford.
By *DENYS PAPIN* M. D. Fellow of the ROYAL SOCIETY.
LONDON,
Printed by *J. M.* for *Henry Bonwicke* at the *Red Lyon* in *S. Paul's* Church-yard. 1681.

A New Digester or Engine for softening bones

On leaving Boyle's laboratory, Papin started work at the Royal Society as assistant to Robert Hooke. By this point Hooke was a famous natural philosopher and architect, but he was also massively overworked, still holding the position of Curator of Experiments at the Royal Society. The Curator was a technician role: constructing, and demonstrating experiments and equipment for society members. Unfortunately, Hooke was not known for his collegiality and Papin seems to have spent his time acting as a poorly paid secretary, being paid per letter written[2].

Despite these difficulties, Papin continued to impress with his experiments and in 1680 was elected fellow of the Royal Society. However, his signature never appeared on the Roll of Fellows as he had already left London for Venice, where he was working as director of experiments at the Accademia Publicca di Scienze. Typically, given Papin's luck, this institution, which was meant to rival the Royal Society, lasted only a few years due to lack of funds. In 1684, he again found himself out of a job[2].

France was still no place for Huguenots under Louis XIV's reign, so Papin found himself back in London, a refuge looking for work. He had built up a sufficiently good reputation that the Royal Society gave him Hooke's old position as Curator of Experiments, but only on a temporary basis. He was paid the same £30 per annum as Hooke had been, but it was the wage

of a craftsman[10] and one that Hooke had always complained about. Also, Hooke had contacts from his time in Oxford who could help top up this wage and promote him[11], while Papin did not. Despite this, Papin took every advantage of the position, wrote many papers and gave many demonstrations of experiments. Unfortunately, however hard he work, it is Hooke who is remembered for holding the prestigious position of Curator of Experiments and never Papin. Papin's luck only went downhill from there.

In 1687, Papin moved to Germany under the patronage of the Landgrave of Hesse in Marburg, only for the Nine Years war to start making life in Europe very difficult. Papin's father died and he was denied his wish to marry his cousin, although he later managed this[3]. Despite it being an active time for Papin as an inventor, the results of his experiments were mixed. It was not that his inventions did not work, but they were not adopted or acknowledged. He invented a pump for ventilating mines, the "plunging boat" (an early submarine), and a grenade launcher. None of which he is remembered for. He lacked the financial clout and status to force the inventions into being widely adopted. The same problem hit the atmospheric steam engine, arguably his greatest invention.

Papin's was the first practical design for a steam engine, but it was never built in more than model form. Worse, the Royal Society gave the patent for the steam engine to Thomas Savery, despite the inferiority of his design. This meant that Papin was almost entirely written out of history. He never saw any financial return from his invention[12].

Denis Papin with an image of his pressure cooker design, unknown artist, 1689

Papin was forced to flee Germany after his employer turned against him. He returned to London in 1707, where he hoped to regain employment with the Royal Society. This did not go well; the Royal Society was struggling for money at that time and, even worse, it was now under the leadership of Sir Isaac Newton. Papin had been communicating closely, and publicly, with Newton's nemesis Leibniz for many years on various scientific matters[13]. Newton and Leibniz's relationship was so antagonistic that anyone with any connection to Leibniz became a victim of Newton's famous temper. Papin was thus frozen out.

Papin was stranded in London, a refugee from religious tensions in France and acrimony in Germany with no source of income. Boyle and Huygens were dead and repeated appeals to the Royal Society fell on deaf ears. Evidence suggests that Papin died in London in 1712, but there is no record of his death and no tomb[2]. It appears that he died alone and desperately poor.

As a technician with Huygens, Boyle, and the Royal Society he excelled. Unfortunately, like so many technicians before, and since, he has been forgotten; indeed, was forgotten even before he died. We should remember Papin because his is the overlooked life of a technician. The Papin Awards recognise technicians who do great things, and it is right that we recognise them so that they do not become lost in the shadow of others.

Timeline of Denis Papin's life

1650

1647 **Denis Papin born in Blois**

1653 **Papin moves to Sammur to live with Uncle**

1660

1666 Great Fire of London

1669 Papin graduates from medical school

1670

1670 **Papin moves to Paris**

1675 **Papin moves to London**

1680

1681 **Papin leaves for Venice**

1684 **Papin returns to London**

1685 Official protection for Huguenots removed

1687 **Papin moves to Germany**

1690

1691 Papin marries cousin

1700

1699 Savery given exclusive patent for steam engine

1710

1707 **Papin returns to London** leaving wife and child

1712 **Denis Papin dies**

1789 French revolution, Protestants gain equal rights

Author

Andy is a technician and laboratory manager in the School of Earth and Environment at the University of Leeds. Alongside his day jobs, Andy has been writing and publishing both academic papers and popular science articles since 2007. His articles have appeared in Physics World, Physics and Chemistry Review, and on Guardian.co.uk. More recently, he has focused on practical science for his blog (**andyjconnelly.wordpress.com**) and writing about technicians, recent, historical, and fictitious.

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A big thank you to my wife, Rebecca Woods, for her help reading the works below written in French where no translation was available. Thank you for that, and for everything else.

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FIScT

Fellowship of the Institute is the most senior grade available and is an indicator of the highest level of achievement within the profession. Individuals may apply or be nominated, according to the guidance laid down by the Executive, and if suitable will be elected by the Fellowship Committee. Applicants for Fellowship would be expected to have at least one year's membership at MIScT level prior to a Fellowship application/nomination, but in exceptional circumstances the Executive may elect Fellows who have not previously been members.

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Some of my thoughts on coaching, mentoring, and technicians

Andy Kowalski

Coaching is often defined as "enabling people to change through learning, but also through doing more, achieving more, and above all else contributing more."

Mentoring, on the other hand, can be said to be the long-term relationship between an individual and either their line manager or other designated person charged with having a longer period overview of their development.

These maxims can be applied in a technical workplace through the process of how technical staff are trained and supported, and how they are continually developed over the longer term to unlock their potential. Taking into account, of course, that a person's potential is something that is very often "beneath the surface" and can be the reason for an individual's stunted progression.

Personal development, and working toward opportunities to move from one level to another higher one, requires people to acquire new skills at the appropriate level and for them to be able to perform consistently well at that level. I found that one way that they can work toward achieving this aim is by adopting the Continuous And Never-ending Improvement (CANI) approach to tasks being tackled. It is typical of something that is practiced in terms of improvement of analytical or problem solving processes.

"CANI" stands for Constant And Never-ending Improvement. It's an acronym that was developed more than a decade ago influenced by the work of Dr W Edwards Deming. Dr Deming is credited as one of the leaders who brought one of the first quality movements to the Japanese. His basic premise was that the secret to help the Japanese achieve world power and economic success was if every single person and organisation commit to constant improvement. The Japanese have a single word for "constant and never-ending improvement" - "Kaizen." Kaizen is from the Japanese words Kai and Zen where "kai" means change and "zen" means good." –Ed

I believe that to coach someone successfully in a technical environment, it is always important that you have a clear understanding of the technician's work and or discipline. It is equally important, I think, that the coach is aware of the most appropriate method for that individual to learn the new skills, so that the whole process is productive and worthwhile.

There are different styles of learning, and which best works for a particular individual is important as it can make a real difference to the ease or difficulty of the whole process. The Visual Audio Kinesthetic (VAK) approach I found to be the best as it is usually the way many people learn effectively. The majority of people find that they understand and pick things up best by seeing them in action.

"The VAK learning style uses the three main sensory receivers: Visual, Auditory, and Kinesthetic (movement) to determine the dominant learning style. It is sometimes known as VAKT (Visual, Auditory, Kinesthetic, & Tactile). It is based on modalities—channels by which human expression can take place and is composed of a combination of perception and memory." – Ed

Looking back on my own original training (in the mid 70s) it was not very structured, or well thought out. It seemed then that technical staff training was rather low on my department's list of priorities, and it appeared that so long as the technicians were delivering what the students needed for their lab class that was enough.

I developed my own knowledge and skills mainly through dogged persistence and a keenness to self-improve. I knew I would benefit in the long term, but it was a real test of my resilience to see this sort of approach through, especially with conflicting demands on my time. Once I had qualified as a chemistry technician, and started to train younger staff, I adopted a more structured approach to the way they learnt new skills. I even got them to record their training in their lab books and tested them on what they had learnt.

As the years went by much new safety legislation began to be introduced, necessitating my further training and my training of others. Safety is a good

example of how the CANI approach can prove really useful for the very often essential and rigorous learning, in terms of compliance, to ensure a clear understanding and prevention of accidents.

I discovered that it was also important for technical managers to not only have a good insight of their subordinate's work skills and knowledge, but also an awareness of their "soft" skills. These soft skills are incredibly important, especially in a university environment for example, where there is often a very high contact time with students (and academics). Students are understandably much more demanding now; they are paying and want value for money, in every respect of the learning process.

I found that it really helps if technicians who are involved in both teaching and research are aware of what these "soft" skills are, and why they are needed. They include empathy, good listening skills, Emotional and Spiritual Intelligence (EQ&SQ), cultural awareness, and a good set of core values such as authenticity, honesty, humility, integrity, professionalism, and trustworthiness.

"EQ & SQ – Emotional intelligence (EQ) is commonly defined as allowing you to judge what situation you are in and then behave appropriately working within the boundaries of the situation, allowing the situation to guide you. While spiritual intelligence (SQ) allows you to ask yourself if you want to be in that particular situation in the first place, or would you rather change it and create a better one working with the situation boundaries, allowing you to guide the situation." Ed

Speaking from experience my advocated approach is but a simple one:

Idea Plan & Action!

1. Have an Idea of what you want to achieve by way of development
2. Make a development Plan with the timescale you need to reach that goal
3. And Action what you need to do at each step of the way

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Recently retired Andy is a former Loughborough University technician. He has a varied and wide range of technical and supervisory experience gained over his 40 years at Loughborough.

Communications and the IST

We are working hard to ensure that we provide our members with the best service that we can, and one of the areas that we have updated is our communications. There are now a number of ways in which we can stay in contact and provide information for our members.

Email – This continues to be our preferred method for direct contact with our members, particularly as we have a significant number of overseas colleagues for whom hardcopy mailings can be problematic (and costly).

Our main email addresses are:
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registrations@istonline.org.uk – enquiries regarding CSci/RSci/RSciTech registrations and renewals

It is important that we have everyone's up-to-date email address so if yours changes please let us know.

Website **(istonline.org.uk)** – We post both important announcements and general information that we think will be useful for our members on our website, so visit us there on a regular basis to see updates.

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John-Paul Ashton MIScT, RSci IST Social Media Engagement Advisor

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LinkedIn and Google+ – join in group discussions, links through to these groups (and our Twitter account and Facebook page) are available on our **website**.

The analytical procedures behind a clinical result

Raffaele Conte

Abstract

In daily clinical practice, measurements of analytes, such as hormones, vitamins, and drugs, are recorded and compared against reference values to determine whether they are within "normal" parameters. Obviously, such clinical result are not derived from a single measurements, but are the result of a complex analytical procedure that uses many processes to obtain a value close to the real concentration of the analyte. This article discusses the mathematical operations that permit the creation of these clinical results. Operations that are relevant to any chemical analysis.

Introduction

A well performed analytical procedure allows clinical laboratories to carry out reliable testing, calibration, and measurement. To ensure accurate results, laboratories must show a continued compliance with regulations, and check that their operational standards are being maintained. This demonstrates to clients that they can trust the clinical measures from that laboratory. It also gives prestige and encourages clients to continue to pay for the serves of that laboratory, an important aspect for private laboratories.

Clinical measurements are based on the quantification of an instrument outcome. This process consists of many steps that start from the construction of a calibration curve and uses various techniques to check the accuracy of the data. The following article describes this process and acts as a simplified guide for medical staff; however, many of the techniques discussed in this paper are relevant to any analytical process.

Calibration graphs: the basis of a quantification

The aim of a clinical laboratory is to produce reliable data with a minimum of errors. This process requires the construction and use of calibration graphs or curves. This technique consists of plotting the instrument response against the known analyte concentrations for series of samples; these samples are referred to as standards.

These standards are usually pure chemicals dispersed in a matrix corresponding with that of the test samples, the unknowns. By convention, the calibration graph is always plotted with the concentration of the standards on the x-axis and the instrument response on the y-axis. The unknowns are determined by interpolation, not by extrapolation. A wide range of standards concentrations must be used to build the curve. Three different practices are commonly used to obtain calibration graphs.

The first method consists of preparing a solution with the same composition as the extractant used for the samples. With this technique, an incorrectly prepared extractant can be detected in blank or control sample. This procedure is useful for the analysis of numerous batches.

The second method requires standards made in the blank extract. This approach is more laborious as standards have to be added to each batch. Therefore, this type of calibration is recommended when few batches are analyzed or when the extractant is unstable. Another disadvantage relates with the difficult detection of an incorrect extractant.

Finally, the standard additions technique is used when there is a strong influence of the matrix; for example, influence of serum, plasma or urine in the analysis with liquid chromatography-mass spectrometry. The procedure consists in taking a number of aliquots of sample and adding different quantities of the analyte to each aliquot, this process is called "spiking". One aliquot, called a blank, is used without the addition of the analyte, as reference, in order to obtain a standard series.[1,2]

Construction and use of calibration graphs

A good quantification requires the statistical establishment of a linear relationship between concentration of the analyte and the instrument response, using at least six measurements. This process is called regression analysis and uses the calibration graph and the correlation coefficient to estimate this relationship. Mathematically, a linear calibration graph takes the general form (Equation 1):

$$y=bx+a$$

Equation 1

Where, a = intercept of the line with the y-axis and b = slope of the calibration graph

Ideally, the intercept a is zero due to the fact that no response of the instrument is to be expected when the analyte is absent. However, because of interactions, interferences, noise, contaminations, and other sources of bias, this event is rare. The slope b is a measure of the sensitivity of the procedure. The steeper the slope the more sensitive the method.

The correlation coefficient r is a measure for the fit of the measured points to a straight line. The correlation coefficient r is calculated (Equation 2):

$$r = \frac{\sum(xi - \bar{x})\,(yi - \bar{y})}{\sqrt{\sum(xi - \bar{x})^2 \sum(yi - \bar{y})^2}}$$

Equation 2

Where: xi = concentrations of standards, $\bar{x}$ = mean of concentrations of standards, yi = instrument response to standards, and $\bar{y}$ = mean of instrument responses to standards.

The correlation coefficient measures the robustness of the relationship between two variables. When the value of r is greater than zero, it is a positive relationship (analyte concentration and instrument response move in the same direction); when the value is less than zero, it is a negative relationship. A value of zero indicates that there is no relationship between the two variables. For positive relationships, the closer the value of r is to +1, the stronger the linear relationship. Then, when the value of the correlation coefficient is below 0.98 it is advisable to repeat or review the procedure.

A further test to check the linearity is described in Equation 3, which regards the relative deviation of the measured y-value and must be applied on three of the highest calibration points:

$$\text{deviation (\%)} = \left|\left(\frac{y_i}{bx_i + a} - 1\right)\right| * 100$$

Equation 3

If the deviations are < 5% the curve can be accepted as linear and used for quantitative measurements. However, random errors are present even in a well-constructed regression line. For these, the estimation of random errors can be obtained through the measure of the standard error (Sy) (Equation 4): [3]

$$Sy = \frac{\sqrt{\sum(y - y^i)^2}}{N}$$

Equation 4

Where $(y\text{-}y^i)$ is the sum of squares error and N is the number of pairs of scores.

Usually, software linked with the analytical instrument is able to automatically generate the calibration curve (figure 1)

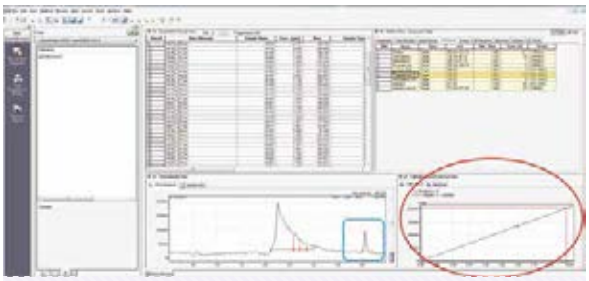

Figure 1 Lab Solution software (Shimadzu) with automatic generation of calibration graph. Each point on the calibration graph, highlighted in red, is obtained by plotting the area of the peak enclosed in the blue square.

Blank and detection limits

A blank is a sample with none of the analyte being measured present. In the case of derivatisation procedures, it can be defined as the sample going through all steps of the procedure with the reagents only. Blank readings are excellent monitors in quality control of reagents, analytical processes, and permit the estimation of several types of detection limits. Moreover, in many analyses, sample results are calculated by subtracting blank readings from sample readings.

The signal of a blank analysis is generally not zero due to the effect of the matrix. Some analysts use to "force the blank to zero" subtracting the blank value from the values of the standards before plotting the calibration graph. A further step in the proper validation of a procedure is the lower limit at which analytes can be detected with sufficient confidence. This parameter is known as the lower limit of detection (LLD). Mathematically, LLD is the concentration of the analyte giving a signal equal to the blank plus 3 times the standard deviation of the blank. Because, in the calculation of analytical results, the value of the blank is subtracted (or the blank is forced to zero) the detection limit can be written as:

$$LLD = 3\ x\ Sd$$

Equation 5

Where the standard deviation "*Sd*" is calculated as (Equation 6):

$$\mathrm{Sd} = \sqrt{\frac{\sum(x-\bar{x})^2}{N}}$$

Equation 6

Where *x* is each value in the data set, $\bar{x}$ is the mean of all values in the data set, and *N* is the number of values in the data set.

At this limit, there is a 93% probability that the signal is not due to the blank but that the method has detected the *presence* of the analyte; this is a qualitative limit. For quantification, another parameter is used called Lower Limit of Quantification (LLQ) (Equation 7):[4]

$$LLQ = 2\,x\,LLD = 6\,x\,Sd$$

Equation 7

A graphical description of these parameters is available in figure 2.

Figure 2: Parameters of calibration graphs

Validation of the procedure

Determining the suitability of analytical data requires a process of validation. This involves determining the performance characteristics of a procedure or process. In particular, there are two main types of validation procedures; the "Validation of standard procedures" and the "Validation of own procedures".

The first involves the testing of the method by a number of selected laboratories according to a protocol issued to all participants. The second is an in-house testing of a procedure to establish its performance. Then, for the validation of own procedures, it is necessary to determine the accuracy, bias, precision, recovery, sensitivity, specificity, selectivity, working range, interferences and robustness of the method.[5]

The accuracy reflects the "true" value for the analyte. Accuracy can be determined with a direct method, or indirect method. The direct method involves replicate analyses on a certified reference sample with a known content of the analyte. The indirect method compares the results of the method with those of a reference method. Numerically, the accuracy can be expressed using the equation (Equation 8):

$$\text{Accuracy } (\%) = \frac{\bar{X}}{\mu} * 100$$

Equation 8

Where $\bar{x}$ is the mean of test results obtained for reference sample and μ is the "true" value given for reference sample. Similarly, the bias is the absolute value and can be expressed by (Equation 9):

$$\text{Bias } (\%) = \frac{\bar{X}-\mu}{\mu} * 100$$

Equation 9

The precision is expressed by the absolute value of the standard deviation. Like the bias, precision is not necessarily the same at different concentrations of the analyte or in different kinds of materials. The acceptable value must be decided depending on the purpose.

The effectiveness of a method is quantified through two processes:

- Recovery experiments: defined as the fraction of the analyte determined after addition of a known amount of the analyte to a sample.
- Measure of the robustness: that is the resistance to variations in the experimental conditions such as temperature, extraction time, shaking technique, pH, purity of reagents, moisture content of sample, sample size, etc.[6,7]

To check the robustness of the method, two further parameters are used:

- Repeatability: defined as the measure of agreement between results obtained with the same method on identical test, or reference, material under the same conditions
- Reproducibility: expressed as the measure of agreement between results obtained with the same method on identical test material under different conditions (e.g. execution by different persons, with diverse equipment, and at different times).

The sensitivity is the value that is required to quantify the analyte on the basis of the analytical signal. The sensitivity for the analyte in the final sample extract could not be equal to the sensitivity for the analyte in a simple standard solution, due to matrix effects. Moreover, the sensitivity usually decreases at higher concentrations due to saturation of the signal. Similar information is given by the working range, which is the interval between the lower and upper limit of analyte concentration that can be measured.

The procedure applied to determine the measuring range requires the measurement of a standard solution of the analyte, in the relevant matrix, at a concentration beyond the highest expected concentration. This solution is then diluted with the matrix until the instrument gives no response. The working range derives from the linear part of the graph obtained from the plotting of the response from these samples versus the concentration. Both sensitivity and working range can be disturbed by the presence of other components. In fact, an analytical method is "fully specific" when it gives a signal exclusively for one particular component and it is "fully selective" when it produces correct analytical results for various components of a mixture without any mutual interaction of the components.

Conclusion

This article acts as a simplified communication of the complex experimental procedure needed for an accurate clinical measurement. Only data derived from precise calibration graphs that pass the validation procedure, and that are inside the working range, can be validated as clinical measures and are released to the customers. The final aim of the described workflow is to guarantee the health of the population through reliable information on the concentration levels of hormones, vitamins, drugs and other physiologic organic molecules.

Glossary

Analyte: a substance that is the subject of chemical analysis (e.g.)
Quantitative analysis: is the determination of the absolute or relative abundance of one or more analytes.
Calibration: is the operation that determines the functional relationship between measured values and analytical quantities characterizing the amount of the analytes
Calibration graph: is a plot of instrumental response (y-axis) with the concentration of the analyte (x-axis).
Extrapolation: is the estimation of a value based on extending a known sequence of values beyond the range that is certainly known. For calibration graphs, extrapolation is when the plotted y value is outside the measured points for the generation of the calibration graph.
Extractant: a solvent used in the extraction of a substance
Interpolation: is the estimation of a value within two known values in a sequence. For calibration graphs, interpolation is given by plotting the measured y value on the calibration graph.
Derivatization: a chemical transformation of the analyte designed to improve analytical capabilities

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Flavourists – the scientific artists

Geoff Passmore

I often think of flavourists as scientific artists. Scientists that not only appreciate a wide spectrum of food and drink, but are also fascinated by what causes these products to taste and smell the way they do. Many people do not understand what a flavourist does; put simply, flavourists make food and drinks have an acceptable, and hopefully amazing, taste.

There are 2,000–3,000 flavour compounds currently used by flavourists, and new compounds are being found almost weekly. Learning the flavour chemistry of all types of essential oils including herbs, spices, and citrus oils, is a very important aspect of a flavourist's training. Also important to learn is how the individual constituent compounds interact with each other. A vital lesson is not only to taste and smell these individual compounds, but to make accurate personal notes that you can refer back to. I remember my own mentor would test me on a weekly basis, checking my ability to differentiate individual flavour compounds.

Vanilla ice cream

Besides essential oils, there are many other flavour compounds that flavourists have to familiarise themselves with. The most important groups consist of esters, alcohols, acids, aldehydes, ketones, pyrazines, amines, furans, phenols, terpenes, and lactones. Some flavour compounds, especially esters, are found in a wide area of both foods and drinks; ethyl butyrate, for instance, is used in many fruity flavours. Furaneol can be found in many flavours, including strawberries and pineapple, and banana flavour often contains isoamyl acetate. Lactones are useful in many creamy and dairy flavours, and pyrazines are present in various nut and roasted meat profiles. One very important compound is, of course, vanillin. This is used extensively in many applications, especially in ice creams and custard powders.

An important area for a flavourist today is the use of some very sophisticated analytical methods. These include Gas Chromatography Mass Spectrometry (GC-MS), Nuclear Magnetic Resonance Spectroscopy (NMR), and High-Pressure Liquid Chromatography (HPLC). With these techniques, it is relatively easy to identify flavour compounds at extremely low concentrations. Quite often, although these compounds are present in low concentrations, their contribution to the flavour profile can be extremely important.

Beef flavoured Monster Munch

After all these years I still get a wonderful feeling, knowing that some of the flavours I have created are providing the taste for products on the market, including beef flavoured Monster Munch. Flavours are created for many applications and certainly help companies both large and small make huge profits. Therefore, a flavourists life is always challenging and variable. From potato crisps to yoghurt, from pharmaceuticals to soft drinks, and pet foods to bakery creams. The flavourists imagination and talents will always be the centre of exciting food and drink creations.

Flavour creation is a multibillion-dollar worldwide industry. Flavourists create many different types of flavours be they, natural, artificial, or reaction types. They are often asked to travel extensively, giving presentations to customers, and sometimes simply giving lectures or mentoring. As young flavourists become more and more experienced, they can expect to earn quite substantial salaries, compared with many scientists. Hopefully after reading this article, a few readers will consider following this fascinating profession.

Author

Geoff Passmore CSci, FIFST, FIScT, FRSC

Geoff originally studied analytical and organic chemistry; whilst at the same time training to become a flavourist. In total his experience has covered about fifty years, and has included working for several of the world's top flavour companies. He is now a "freelance" master flavour consultant and mentors young flavourists all over the world. Geoff is a Chartered Scientist, a Fellow of the British Society of Flavourists, a Fellow of the Institute of Food Science & Technology, a Fellow Member of The Royal Society of Chemistry, and a Fellow Member of The Institute of Science & Technology. Most of Geoff's flavour creation experience involved applications relating to food and drinks.

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Sam McCormack's #TechnicianJourney

As told to Andy Connelly

Samantha recently gained a special commendation at the Papin Awards for her work as a Simulation Technician. This is her* **#TechnicianJourney.**

If somebody had told me when I left school that I would find a job I love and that it would involve making vomit out of soup, lemon juice, and parmesan cheese, I'd have thought they were winding me up. And yet, that is exactly what I spend my days doing.

It started when my youngest began primary school and I applied to be a teaching assistant at the local secondary school. Working with the students in lessons was great and I went on to train as a higher-level teaching assistant. I was promoted to deputy head teaching assistant - I was very happy there. Unfortunately, there were redundancies, pay cuts, and a big shake up. It was awful. As a way out, I went for a job at Buckinghamshire New University in the Faculty of Society and Health. I applied because the job title sounded so exciting - laboratory technician.

I didn't really know what a laboratory technician was, but I had a vague idea it involved potions and lotions. Anyone who knows me knows I love that sort of thing, so I thought I'd give it a go. It took six weeks to hear anything after I applied, and I'd just about forgotten about it. I got the call and I was successful. I was gobsmacked, I couldn't believe it.

Looking back, what shocked me most was that two of the people who went for the role were nurses. I'm not clinically trained at all, I have no nursing background. When I went for the interview I only had GCSE level English and Maths and some qualifications I had gained while working as a teaching assistant. Getting the job really gave me so much confidence because I thought they must have really liked me.

I soon discovered the role was less about creating potions and more about supporting nursing students and setting up equipment for practical simulation sessions. In these sessions students could practice treating wounds and things like that. However, after I had been working there six months I was thinking, "I've made a huge mistake. I can't work here, this isn't the job I thought it was." I'm not an emotional person but I was coming home and wanting to burst into tears because I really didn't feel like I was getting anywhere.

I didn't want to just leave, so I decided to observe every single session I could to use my time wisely. In one session, the lecturer said to a student, "Pretend there is a wound on this arm." I thought, why are they pretending? Why don't I just put one on there? I'd never done anything like it before, but I thought I'd just give it a go. I now know that the art of applying makeup for training purposes is called moulage.

I'd never written a business case before but I believe that as you go through life, you can either be positive or negative. The trouble is, if you are negative you're only affecting yourself. I went in positive, with facts and figures, to see the Head of School. I asked if I could go on a casualty makeup course at Ealing Studios and she said yes! I attended the course and my love affair with moulage really took hold.

I returned from the course and things really took off. There could be fifteen sessions all wanting wounds at the same time. Everyone wanted a piece of me - I physically couldn't keep up. I was creating wounds on real people for lectures and for the simulation laboratory sessions. This just hadn't been done before at the university, but it made a real difference to the students and the lecturers. Where other universities might do a bruise on a mannequin, we encourage our students and staff to be volunteers for moulage. They love having their image on social media with a wound.

I progressed onto making body fluids and stool samples. These were easier than the wounds as I could make them up beforehand. We mostly use household products to keep our costs down. Our latest development is babies' nappies. I'm not clinical, but being a mum of four, I know what the nappy would look like if one of my children is unwell. Our lecturers can now pass around a nappy and just say, "Tell me about that nappy. Does this child have colic? Is it breast fed?" Finally I was really mixing potions!

I still wanted more though. I wrote another business plan to change my job title. After lots of discussions a new job title, Skills and Simulation Supervisor, was created and I was in this post for five years when a new post was created, Skills and Simulation Facilities Team Lead, I applied and was successful. I now have a team of five technicians who I have trained in moulage. We support over a thousand students each week who pass through seventeen simulation areas. We support students and lecturers in nursing, operating department practitioner, sport science, sport therapy, psychology, and crime scenes. I wouldn't have had the confidence to do anything like this seven years ago.

The course leaders call me a specialist. I've never claimed I'm a specialist, but they say, "We've got this specialist make-up artist!" When people told me how fantastic my work was, it just empowered me and I hope I am empowering my team in return. We have a great time.

This year I am graduating with a Masters in Medical and Healthcare Simulation from The University of Hertfordshire. With no first degree that was a challenge. On top of that I also became a Registered Scientist and, in May, I was shortlisted for the Papin Awards. I was really, really, chuffed to be nominated and to be picked out from 200 applications was amazing. I had never heard of the Papin Awards and the idea of recognising technicians is just amazing. I will be nominating some of my team next time!

I didn't win, but I was highly commended and I received a certificate – "Recognising Technical Excellence in Academia". The whole experience of the day was a fantastic culmination of seven years of work. I keep telling my other half, I'll have some time doing nothing soon...but I'm not finished quite yet.

** If you want to know more about simulation technicians you can contact the Association for Simulated Practice in Healthcare (**aspih.org.uk/**). If you want to know more about moulage, Samantha is always willing to talk about her work (@sirmanfer).*

From the archives: Fritz Haber: ammonia, poison gas and gold

Alan Gall, IST Archivist

Figure 1: Fritz Haber and Albert Einstein in Berlin c. 1910 (Otto Hahn, 1967)

War

Controversy has often surrounded the selection of Nobel Prize recipients, seldom more so than in 1920 when Fritz Haber stepped up to the podium to receive his award "for the synthesis of ammonia from its elements, nitrogen and hydrogen."[1] Branded a war criminal, he actively promoted the use of poison gas against the Allied forces during World War One. His presence at the ceremony must have caused great embarrassment for the organisers as many stayed away in protest. When, much later, German physicist Max Born invited Ernest Rutherford to meet Haber at a tea party, Rutherford responded violently that he "did not wish to have any contact with the man who had invented chemical warfare".

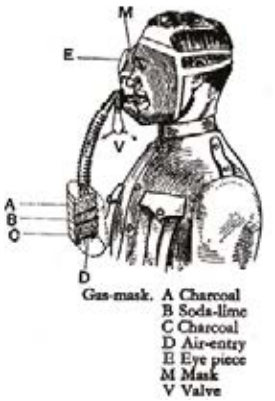

Figure 2: A military gas mask shown by F. Sherwood Taylor (1936)

It [chlorine] was the obvious poison gas to use in warfare, for it is not only poisonous but heavy and cheap. The results were terrible. The delicate membranes of the lungs irritated by the gas defended themselves by pouring out quantities of fluid designed to wash away the irritant: the effect was, the victim was drowned in the exudations of his own lung tissues – F. Sherwood Taylor, 1936.

Fritz Haber always maintained that his motive was to promote a quick, and hence more humane, way of ending the conflict. The Allies responded in kind and in the end poison gas only succeeded in giving an advantage to those with the wind in their favour.

The catalytic production of ammonia gave Germany the ability to overcome an Allied blockade that strangled the supply of nitrates for explosives production. Since Friedrich Wilhelm Oswald had already developed and patented (in 1902) a method for oxidising ammonia to nitric acid, the means for nitration on an industrial scale were at hand. The scaling-up of Haber's laboratory synthesis, which culminated in the opening of a plant in 1912, was due to Carl Bosch: hence the naming of the Haber-Bosch process.

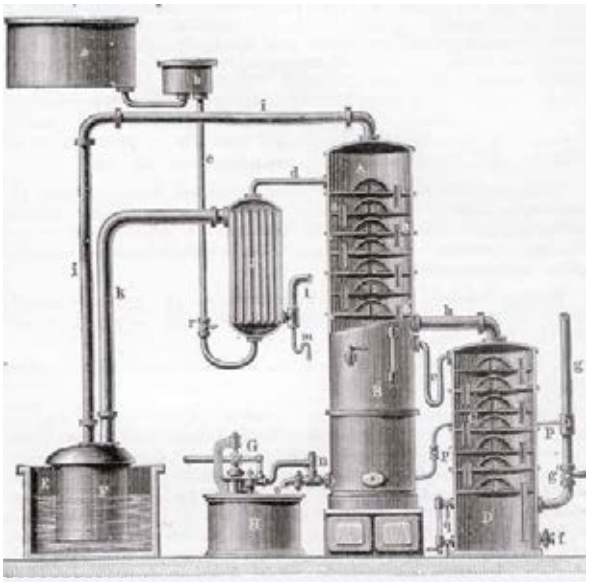

Figure 3: Prior to the Haber-Bosch process, large quantities of ammonia and ammonium salts were recovered as by-products from the treatment of coal. Illustrated is an ammonia still, fed with "ammoniacal liquor" from coke ovens (Partington, 1927)

Haber developed further toxic gasses. This work continued after the war, despite a newspaper quoted Haber as saying that "Germany knew less of modern chemical warfare than any country in the world because the Versailles Treaty forbids the carrying out of experiments."[2] It is speculated that his wife Clara's suicide in May 1915 was due to the participation in mass poisoning.

Death and destruction were not the only fruits of the ammonia synthesis. The massive output allowed copious amounts of fertiliser to be made. This in turn stimulated crop production and kept millions fed.

As numerous authors have pointed out, the tally of war casualties due to Haber's efforts was far lower than those saved from starvation in the following years.

And peace

The industrial-scale preparation of ammonia prolonged the war but eventually the guns fell silent and Haber found that his name had been added to a list of war criminals. According to Otto Hahn, Haber grew a beard to avoid recognition, then fled to Switzerland. He returned to Germany when, for some reason, the charge was dropped.

On 7th July 1919, the German government ratified the Treaty of Versailles. Under this agreement, Germany accepted sole responsibility for starting WWI and agreed to pay compensation for the vast loss of lives, property and materials. The cost of this: a complex mixture of hard cash, land, natural resources, goods, and an undertaking to build 200,000 tons of shipping per year for the Allies. A reparations commission tussled with the fine details all through 1920. The commission finally came up with a figure and announced on April 27th 1921 that Germany should pay 132,000,000,000 gold marks. This, of course, did not do an already devastated Germany economy much good and resulted in hyperinflation. The German mark was literally not worth the paper it was printed on. A picture of the time shows children playing with numerous bundles of bank notes.[3]

To the rescue, or so he thought, came Fritz Haber with a plan to extract gold from seawater. Although the concentrations were low, Haber felt that the recovery value would outweigh the processing costs. Unfortunately, his initial assumption of the likely concentration turned out to be several orders of magnitude too high.

In what follows, 1 tonne = 1000 kg (also called the metric ton).

There's gold in them thar seas

The idea of harvesting the sea's gold seems to have been prompted by Harber's recollections of reading an optimistic estimate of its abundance by Swedish chemist Svante August Arrhenius. Edward Sonstadt's paper "On the Presence of Gold in Sea Water" in *Chemical News* (1872) gave a value of 65 µg/l (1g in 1.5 x 10^4 litres). And as a possible means of extraction, a patent application of 1899 gave details of how the gold, as gold iodide, could be treated with calcium hydroxide to form calcium iodide and metallic gold. The inventors stated, "... notwithstanding the large volume of water to be dealt with and the minute quantities in which gold is found, the desired object can be effected with commercial success." An over-optimistic notion, to say the least.

Stimulated by a strong patriotic desire to help his country, and encouraged by the available information, Haber set up a team headed by Johannes Jaenicke to look into the possible extraction. Fritz and his team set sail to test the waters, using laboratory facilities aboard the ocean liner *Hansa*. When the ship docked at New York on 29th July 1923, the crew manifest showed an impressive number of assistant pursers, actually the cohort of gold prospectors. Most, if not all, of the seven seas were investigated over the next few years, either directly or through special arrangements. The Danish research ships *Dana* and *Godthaab*, for example, provided samples from the coastal waters off Iceland and Greenland.

Reports began to circulate that after 5000 analyses, the highest levels had been found off Newfoundland but still short of a viable concentration and as the analytical techniques were improved, so the gold content diminished. The final averages were almost a thousand times less than the originally expected milligrams per tonne, dashing all hope of economic recovery (see figures 4 and 5).

Modern analytical methods have reduced the concentration of gold still further. Using inductively coupled plasma quadrupole mass spectroscopy (ICPMS), Falkner & Edmund obtained the range 50 – 150 fmol/l (1 –3 x 10^{-11} g/l) for a number of different locations. The authors comment that the figures are nearly three orders of magnitude less than those reported in the literature prior to 1988. Taking a recent value for gold as £1000 per ounce and 29 pg/l for the level in seawater (Koide et al), 10,000 tonnes of water would contain one pence worth.

In Maria Marconi's book *Marconi My Beloved* (1999) is the highly unlikely claim that the great radio pioneer also developed a feasible method of gold extraction. Using a piece of coal enclosed in a wire mesh (connected to "mysterious electrical instruments"), lowered from the porthole of his yacht, he collected visible quantities of the metal "in a few hours" to the delight of his wife and daughter.[4]

Despite the failures of the past, the dream of riches from the sea is still alive and well, stirred on by the multi-million tonnes of gold awaiting recovery.[5] Numerous postings on the Internet suggest various techniques that might be applied, including the idea that ships' propellers might double up as electrodes for gold deposition.

Quoted level	g/litre	Notes
5-10 mg/m^3	0.5 to 1 x 10^{-5}	Assumed by Haber based on published results
0.01 mg/tonne	1 x 10^{-8}	Average found in San Francisco Bay
0.055 mg/tonne	5.5 x 10^{-8}	Highest found in San Francisco Bay
0.047 mg/tonne	4.7 x 10^{-8}	Average found in the Arctic Ocean
0.008 mg/tonne	8 x 10^{-9}	Mean value found by the ship Meteor
0.044	4.4 x 10^{-8}	Highest value found by the ship Meteor

Figure 4: ***Comparison of gold concentrations in seawater found by Haber's team (Dietrich Stoltzenberg, 2004)***

Quoted level	g/litre	Notes
13 billionths g/l	1.3 x 10^{-8}	https:/oceanservice.noaa.gov/facts/gold.html
8 x 10^{-6} ppm	8 x 10^{-12}	https:/web.Stanford.edu/group/Urchin/mineral.html
65 µg/l	6.5 x 10^{-5}	Sonstad's 1872 figure quoted in Koide et al (1988)
29 ± 9 pg/l	2.9 x 10^{-11}	Overall open ocean average in Koide et al (1988)
100 fmol/l	2 x 10^{-11}	Average of findings in Falkner & Edmond (1990)

Figure 5: ***Comparison of published figures for gold concentrations in seawater. The first figure is assumed to be an American billionth = 10^{-9} although 10^{-12} gives a better agreement with other values. Calculations based on 1000 litres of seawater ≈ 1000 kg***

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Notes and references

1. Because of the war, the 1914-1919 awards were not announced by the Swedish Royal Academy until 1920. There were a total of five Germans named: Max von Laue, Richard Willstätter, Max Planck, Johannes Stark and Fritz Haber.

2. *London Daily Telegraph* 13th September 1924. Reporting on Fritz Haber's visit to the Franklin Institute at Philadelphia.

3. Entry for 22nd June 1923 in Derrik Mercer (ed), *Chronicle of the 20th Century* (London: Chronicle Communications, 1988).

4. http://lateralscience.blogspot.co.uk/2013/04/marconi-gold-from-seawater.html (accessed 16/09/2017)

5. The volume of the world's oceans has been calculated to be 1.335 x 10^{21} litres. See https://www.ngdc.noaa.gov/mgg/global/etopo1_ocean_volumes.html (accessed 23/09/2017). Even at a level of 2 x 10^{-11} g per litre, that works out at about 27 million tonnes of gold.

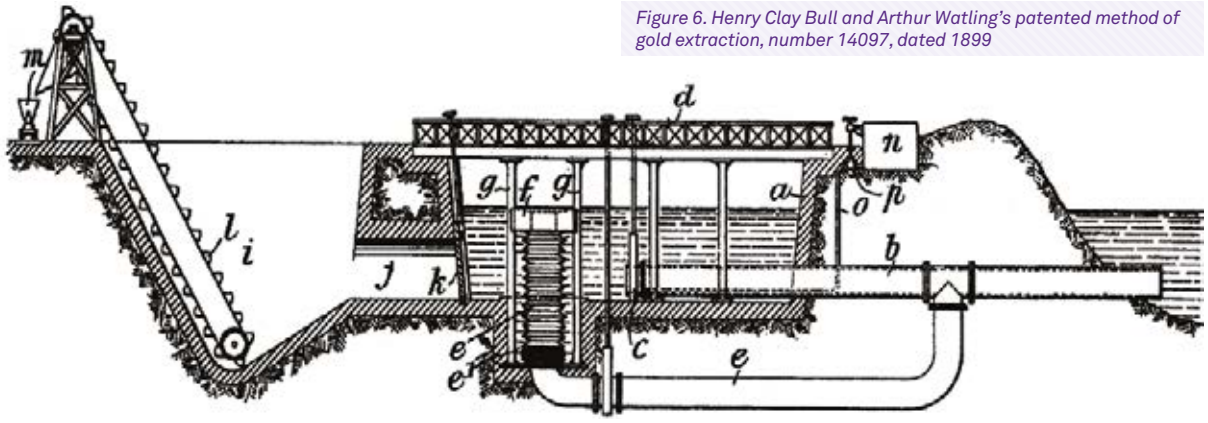

Figure 6. Henry Clay Bull and Arthur Watling's patented method of gold extraction, number 14097, dated 1899

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Detect... Lock on... Intercept: The remarkable hunting ability of the robber fly

Robber Fly with prey (Holcocephala fusca) (credit: Thomas Shahan (Wikipedia))

A small fly the size of a grain of rice could be the Top Gun of the fly world, with a remarkable ability to detect and intercept its prey mid-air, changing direction mid-flight if necessary before sweeping round for the kill.

The robber fly, *Holcocephala*, is a relatively small fly at 6mm in length; it is similar in size to the average mosquito. Yet it has the ability to spot and catch prey more than half a metre away in less than half a second. In comparison to its size, this would be the equivalent of a human spotting its prey at the other end of a football pitch. Even if the prey changes direction, the predator is able to adapt mid-air and still catch its prey.

An international team led by researchers from the University of Cambridge was able to capture this activity by tricking the fly into launching itself at a fake prey; in fact, just a small bead on a fishing line. This enabled the team to witness the fly's remarkable aerial attack strategy. Their findings are published today in the journal *Current Biology*.

The robber fly has incredibly sophisticated eyes. Like all flies, it has compound eyes made up of many lenses, and in the case of the robber fly it is thought to have several thousand lenses per eye. However, unlike many species of fly, it has a range of lens sizes, from just over 20 microns to around 78 microns, the width of a human hair. The larger lenses are the same size as those of a dragonfly, which is believed to have the best vision of all insects but is 10 times larger, and helps reduce diffraction which would otherwise distort the image.

"There's a trade-off going on between having excellent vision – which requires bigger lenses – and the size of the insect. The only way a robber fly could have vision as excellent as the "poster child" of predatory insects, the dragonfly, across its entire visual field would be to have an eye with many more and larger lenses – but then the fly itself would need to be much larger to be able to carry it." – Dr Paloma Gonzalez-Bellido from Cambridge's Department of Physiology, Development and Neuroscience

To get around this problem, the robber fly has a concentration of larger lenses in the centre of its vision, accounting for only around one thousandth of its visual space. The lenses get smaller in size around the outside of the eye. Importantly, the team of researchers also showed that below the very large central lenses, this robber fly has evolved extremely small light detectors, which are placed almost parallel to each other and much further away from the lens than normal. This arrangement preserves the high local image resolution, which is very close to that of much larger dragonflies.

When it sees a potential prey, the fly launches itself upwards while maintaining a "constant bearing angle", in other words, it moves in a direction such that while moving closer and closer to its prey, it still maintains the same relative bearing. This ensures that it will intercept its prey.

Sam Fabian, a PhD student working on the project said, "If you think of this as though you're driving along the motorway and a car is coming down the slip road, then if the relative angle between you and this car remains constant, you will collide. Of course, you'd take evasive action, but in the case of the robber fly, this is what it wants."

This strategy of maintaining the constant relative bearing also allows the robber fly to manoeuvre itself mid-air in the event that its prey changes direction. The researchers demonstrated this by switching the

direction of their fake prey while the robber fly was mid-flight and observing how the fly responded.

Once the fly is around 29 cm away from its prey (though exactly how it judges this distance is still unclear) the fly displays a remarkable strategy never before observed in a flying animal. It "locks-on" to its prey while changing its own trajectory, enabling it to sweep round, slow down, and come alongside the prey to make its final attack.

The researchers believe the robber fly's sensory system, which maximises precision in its vision while minimising the amount of information needing processing, is the key to its ability to capture prey as accurately is it does while retaining such a small body size. This technology could be harnessed by manmade flying robots, or drones, they say.

Dr Gonzalez-Bellido explained, "The problem with drones is often one of the battery power necessary for accurate image processing. The processing power is a huge drain on resources. But as is often the case, we can take lessons from the natural world to minimise the power requirements. This, combined with the robber fly's remarkable hunting ability, could help in the design of drones designed to take down illegal drones near airports, for example."

Reference

T.J. Wardill, et al., 'A novel interception strategy in a miniature robber fly with extreme visual acuity', Current Biology, Vol. 27, no. 6, 2017, p. 854–859.

Gold discovery could improve cancer treatment

Researchers funded by the Engineering and Physical Sciences Research Council (EPSRC) have discovered new properties of gold which could be utilised to improve the effectiveness of cancer medication, and reduce its harmful effects.

Scientists at the University of Edinburgh have completed a study which demonstrated that gold specks can boost the effectiveness of drugs used to treat lung cancer cells. The discovery, researchers say, could also reduce the side effects of chemotherapy treatments by precisely targeting diseased cells, without damaging healthy tissue.

Carried out in collaboration with the University of Zaragoza, and funded by Cancer Research UK, the study looked at the catalytic properties of gold, which can accelerate chemical reactions. The new properties discovered by the researchers allow gold's catalytic abilities to be accessed in living things without any side effects.

They encased minute gold nanoparticles in a chemical device to localise chemical reactions in specific sites. The device was shown to catalyse a directed chemical reaction when implanted in the brain of a zebrafish, suggesting it can be used in living animals.

Gold nanoparticles also activated anti-cancer medicines that had been applied to lung cancer cells in a dish, increasing the drugs' effectiveness. Dr Asier Unciti-Broceta, from Cancer Research UK, said, "There is still work to do before we can use this on patients, but this study is a step forward. We hope that a similar device in humans could one day be implanted by surgeons to activate chemotherapy directly in tumours and reduce harmful effects to healthy organs."

Study of 11,000 years of West Antarctic Ice Sheet loss sheds light on today

BAS Twin Otter aircraft on the Antarctic ice sheet

Reporting in the journal Nature, an international team of researchers led by NERC's British Antarctic Survey (BAS) explains that wind-driven incursions of warm water forced the retreat of glaciers in West Antarctica during the past 11,000 years. These new results enable researchers to better understand how environmental change may impact future sea-level rise from this climate-sensitive region.

By studying tiny shells in seafloor sediment cores retrieved from Pine Island Bay in West Antarctica, the team has reconstructed the interactions between the ice and ocean from 11,000 years ago until present. They describe the West Antarctic Ice Sheet (WAIS) as having experienced significant and sustained ice loss until 7,500 years ago, driven by warm water incursions. The influx of warm water then subsided for several thousands of years until it was reinvigorated in the 1940s, driving further retreat.

The WAIS is of great interest to researchers as two of its largest glaciers, Thwaites and Pine Island, are draining into the sea and contributing to sea-level rise. The big questions are why, by how much, and what may happen in the future under climate change.

"This ten-year study has yielded some exciting results. By understanding the mechanisms that caused the retreat of the WAIS over the past several thousand years, we can begin to build a clearer picture of what is happening today." – Senior Marine Geologist at BAS, and lead author of the study, Dr Claus-Dieter Hillenbrand

Data collected over the last 20 years have shown that the present ice loss in West Antarctica results from the relatively warm water from the deep ocean flowing on to the shallow continental shelf. This warm water reaches the coastline in places, where it triggers substantial melting of the floating parts of glaciers and leads to thinning of the ice upstream.

The study's reconstruction shows that warm deep water flooded Pine Island Bay at the end of the last ice age. It forced the ice to retreat but stopped at about 7,500 years ago, when the belt of westerly winds driving the deep water onto the shelf shifted northwards.

Ice loss from this part of West Antarctica is already making a significant contribution to sea-level rise, around 1mm per decade, and is actually one of the largest uncertainties in global sea-level rise predictions. Whilst this is a small figure in actual terms, combined with the contribution from other melting glaciers around the world and expansion of the world's oceans, it will have an impact upon society through flooding of low-lying coastal regions.

Understanding what happened in the distant past provides another important part of the jigsaw. Computer model simulations have suggested that ice-sheet melting through warm water incursions could initiate a collapse of the WAIS within the next few centuries, raising global sea-level by up to 3.5 metres.

The team investigated sediment cores collected from Pine Island Bay in the Amundsen Sea from the German research vessel RV Polarstern on two expeditions in 2006 and 2010. The team analysed the chemical composition of tiny shells built by organisms (foraminifera) that had lived in the water column and at the sea bottom before their shells became embedded in the seafloor sediments. This chemical composition acts as a "fingerprint" of the water that the shells were formed in. By comparing these shells with those of modern shells bathed in warm deep water today, the researchers were able to identify time intervals when warm deep water was either present or absent.

The data also reveal a more recent history of the WAIS. A shift in the wind direction during the 1940s caused renewed upwelling of warm deep water on to the shelf. This has continued ever since and is responsible for the ice loss we are observing today and over the last few decades.

The results provide evidence that in the past WAIS retreat was also predominantly caused by melting through warm ocean water. This gives confidence in the predictions of the current generation of ice-sheet models which are used to forecast future ice loss from Antarctica and resulting sea-level rise.

Several of the team are now are working on a new project to provide estimates of ocean temperatures during this time interval.

Industry and university partnerships to power a creative revolution

Image credit: TT Games, maker of LEGODimensions, is one of the growing games businesses celebrated in Games London

"From film, TV and games to design, architecture and fashion, the UK has one of the world's most powerful, innovative and fastest growing creative economies, growing twice as fast as the wider economy in terms of both value and jobs. The creative industries are essential to the UK's future prosperity. But as the sector continues to expand internationally, and looks to adapt to new technologies and exploit new opportunities, skills gaps are becoming more evident; we need to develop our already highly creative workforce to make it fit for the future." – Professor Andrew Chitty, recently appointed AHRC Creative Economy Champion

The Creative Industries Clusters Programme, which will start in 2018, will help catalyse economic growth and provide the skills needed for the jobs of the future. It will find innovative ways to identify opportunities for new products and services at an early stage and get them on the road to success. Led by the Arts and Humanities Research Council (AHRC), the Programme will support eight Research and Development (R&D) Partnerships between industry and a group of universities to respond to challenges identified by the creative industries in their cluster.

The R&D Partnerships will support ground-breaking innovation by companies of all sizes, from micro-businesses and start-ups to multinational corporations, so that they can prosper in the UK. This will ensure that the UK benefits from their success and building on its global reputation as one of the world's leading engines of creativity.

In parallel, a national Creative Industries Policy and Evidence Centre will be established to produce independent evidence and analysis for the industry and for policy-makers. The Centre will produce high-quality understanding of the creative industries, including how they are working together in clusters and across the wider economy, so that future policy and strategy can be informed by world-class insights to further accentuate success.

The Industrial Strategy Challenge Fund will invest £39m in the Programme until 2021, which will be matched by university and private sector funding that will take the total investment to at least £80 million.

Professor Andrew Thompson, Chief Executive of Arts and Humanities Research Council said, "This will be a once-in-a-generation opportunity for those universities that are involved: this is a chance for them to show how they can play an essential role in the creative economy. They will be able to build on their creative industry networks, locally, nationally and internationally, at a scale not previously seen."

Double fish production while preserving biodiversity – can it be done?

(Photo credit: Tarang Mehta, Earlham Institute)

Tanzania, perhaps best known for safaris over its vast open plains, has ambitious plans for diminutive freshwater wildlife with enormous, untapped potential.

Tilapia fish, second only to carp as the world's most frequently farmed fish, live in huge numbers in the Great Lakes (Victoria, Tanganyika, Malawi/Nyasa) that cover 6% of the country. The Great Lakes are considered a global biodiversity hotspot (one of only 25 worldwide) due to the hundreds of species of cichlid fish, including some of the 30-odd known subspecies of tilapia that are found in Tanzania.

However, Tanzanians eat on average only 8kg of fish per year, less than half the international average of 17kg. Around a third of children under five are deficient in iron and vitamin A, contributing to stunting, while about a third of women between 15-49 years old are deficient in iron, vitamin A and iodine.

Fish also provide nutrients in a more efficient way than other sources of animal protein because they convert more of their food into body mass. Some types, such as tilapia, are particularly attractive because they can be reared largely on inexpensive vegetable matter and agricultural waste, while many of the fish species reared in the developed world have to be fed on fish meal.

At the moment, tilapia farming in Tanzania is mostly for subsistence or for small-scale markets and often uses non-native species, such as Nile tilapia. Around half of the world's tilapia species are native to Tanzania, but 99% of commercial production is currently in China, Honduras, and the US.

To develop an aquaculture strategy for Tanzania, 30 scientists representing Tanzanian stakeholders, as well as international research organisations, including the Norwich based Earlham Institute, met for a three-day workshop in Zanzibar. The main outcome of this workshop was a new collaboration between the Tanzanian government, industry, international scientists, and funders that could help double the production of fish in the country by 2025.

"By sharing the results of genetic analysis and helping to build expertise, we can make a real contribution to helping to grow a national industry. A Tanzanian aquaculture seed bank could also be valued by breeders worldwide, for example by offering strains adapted to harsh environments. I am grateful to our Global Research Challenge fund awarded by BBSRC, which have allowed us to contribute to this amazing effort and lay the foundations for aquaculture development in Tanzania. It has been an inspiring and humbling experience to be part of this endeavour." – Director of Science at the Earlham Institute, Federica Di Palma

The National Aquaculture Research and Development Centre (NARDC) aims to improve access to this nutrient-rich resource, especially for women, and to triple the contribution that aquaculture makes to the economy. Tilapia species from a broad range of ecosystems will form the focus of the research. Genetic analysis of 31 species, including 26 that are found nowhere else on the planet, could reveal important traits for creating the country's own commercial brood stock.

Using native species could also help secure the nation's biodiversity. For example, it eliminates the risk of non-native strains escaping and hybridising with wild species. One species, Singida tilapia, is virtually extinct in its natural habitat since Nile tilapia and perch were introduced in the 1950s.

The School of Biological Sciences at Bangor University are working with Earlham Institute to develop a phone app to help fish farmers check the authenticity of any fingerlings (young fish). It could help identify regions particularly rich in pure species, where conservation measures could be put in place. It could also flag up regions with a high number of hybrids that pose a biosecurity risk.

The provision of healthy fingerlings of varieties that are well adapted to local production environments is a key requirement for aquaculture in any country. However, to establish and maintain a brood stock that can supply the industry with fingerlings requires long-term investments in infrastructure and training.

Lessons learned from the worldwide aquaculture industry, which in 2013 overtook beef production, will help ensure that sustainable practices are adopted from the start. Tanzania's unique tilapia could become as valuable as the country's gold but with more people able to experience the benefits more equally.

Experimental gaming studio awarded new funding

Credit: The Chinese Room, Brighton UK

A game development studio based in Brighton, The Chinese Room, is one of 15 companies to receive new funding, announced by Matt Hancock, Minister for the Department of Culture, Media and Sport, at the 2017 London Games Festival.

Anchored on cutting-edge gaming narrative research funded by the Arts and Humanities Research Council (AHRC), The Chinese Room studio created the award-winning game Dear Esther, which received five BAFTA nominations in 2013. They also created Everybody's Gone to the Rapture which won three BAFTAs, in music, innovation, and game performer, and seven other award nominations in 2016.

As Part of the UK's Digital Strategy, the UK's Games Fund Community Interest Company is funded by government in order to help establish and develop the UK's gaming sector. The Chinese Room has now been awarded a further grant from this fund to continue the revolutionary work in game production.

Dr Daniel Pinchbeck, the Creative Director of The Chinese Room, began with his research at the University of Portsmouth, funded by the AHRC. Dr Pinchbeck explored the roles of narrative and first-person perspective in gaming, one of the most popular gaming perspectives globally. Arguing that the content of these games tended to be comparatively simplistic, Dr Pinchbeck sought to address this problem by enhancing the gaming experience in first-person perspective mode. The result was the award-winning Dear Esther in 2013.

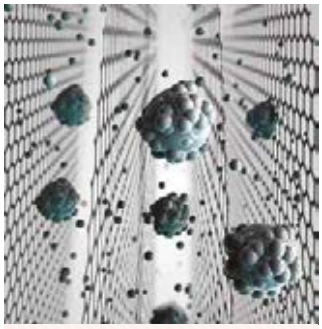
Owing to the huge international success of Dear Esther, Dr Pinchbeck was awarded a further grant to continue his experimental gaming research, which led to the development of other highly successful games including Everybody's Gone to the Rapture, released by Sony for PS4.

Not only is Everybody's Gone to the Rapture a step beyond the standard commercial game, but it is an example of a UK success story. A small academic team who received AHRC funding at key moments of the research and prototype stages who have gone on to create jobs in the UK, partner with a major international publisher, and showcase the benefits for both academia and industry for knowledge exchange and partnership.

During his speech at the London Games Festival, Matt Hancock said, "Video games, and the wider creative industries, are at the heart of our work on developing a new Industrial Strategy."

The success story of The Chinese Room gaming studio highlights the essential role research has in developing UK's gaming industry, worth £4.3 billion, and continuing to establish the UK has a global leader in the creative industries and digital economy.

Graphene sieve could make seawater safe to drink



(Image credit: Manchester University)

The work of researchers utilising graphene to develop a sieve that can turn seawater into drinking water has attracted widespread media coverage.

The team from the University of Manchester have published their latest findings in the journal *Nature Nanotechnology*, as part of an ongoing project supported by the Engineering and Physical Sciences Research Council (EPSRC).

The team have achieved the breakthrough of making graphene-oxide membranes capable of sieving common salts, a development which has the potential to provide clean drinking water for millions of people who struggle to access adequate clean water sources. Previous research found that the membranes became swollen when exposed to water, meaning that smaller salts flowed through alongside water. However, they have now developed a new method allowing them to control the pore size of the membranes, meaning common salts can be sieved out and the water made safe to drink.

Of his work, Professor Rahul Nair, from the University of Manchester said, "Realisation of scalable membranes with uniform pore size down to atomic scale is a significant step forward and will open new possibilities for improving the efficiency of desalination technology."

Paper co-author, Mr Jijo Abraham, explained, "The developed membranes are not only useful for desalination, but the atomic scale tunability of the pore size also opens new opportunity to fabricate membranes with on-demand filtration capable of filtering out ions according to their sizes."

With the UN predicting that 14 per cent of the global population will encounter water scarcity by 2025, the breakthrough could have major implications for the development of accessible desalination technology.

Scientists uncover how sunlight on skin reduces eczema inflammation

A new study has identified how exposure to sunlight alleviates symptoms of eczema by triggering the release of a compound in the skin that dampens inflammation. The Medical Research Council researchers say that their findings pave the way for new therapies that mimic the effects of the sun's rays without the damaging side effects.

People with severe eczema are often prescribed UV light therapy, using tanning lamps, which can improve the itchy skin lesions associated with the condition. However, the UV can have damaging side effects on their skin, including burning, ageing, and raising their skin cancer risk.

The study, published in the *Journal of Allergy and Clinical Immunology*, found that exposing a small patch of skin on healthy volunteers to UV light triggered nitric oxide to be released into the blood stream. Further lab studies found that the chemical activated specialised immune cells, called regulatory T cells, which act to dampen the ongoing inflammatory immune response.

In patients with eczema, the proportion of these regulatory T cells in their blood following light therapy directly correlated with disease improvement. Researchers say their findings could lead to new therapies for eczema, which affects around one in five children and one in 20 adults in the UK.

Graphene “electronic skin” could harness solar power to return sense of touch to amputees

Dr Ravinder Dahiya (Photo credit: University of Glasgow)

Engineers at the University of Glasgow have utilised graphene to develop a solar-powered “synthetic skin” that could be used to create advanced prosthetic limbs for amputees.

The Bendable Electronics and Sensing Technologies (BEST) group, led by Dr Ravinder Dahiya, believe their breakthrough could see 2D material graphene’s physical properties utilised to harvest energy from the sun to power the skin and return the feeling of touch to amputees.

The BEST group’s findings are published in a research paper published in the *Advanced Functional Materials* journal, which details how they have integrated power-generating photovoltaic cells into an ‘electronic skin’ made from graphene for the first time.

Graphene is a highly flexible form of graphite which, despite being just a single atom thick, is stronger than steel, electrically conductive, and transparent. It is graphene’s optical transparency, which allows around 98 per cent of the light which strikes its surface to pass directly through it, which makes it ideal for gathering energy from the sun to generate power.

Human skin is an incredibly complex system capable of detecting pressure, temperature, and texture through an array of neural sensors which carry signals from the skin to the brain.

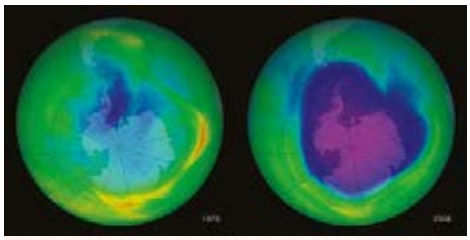
Dr Dahiya and his colleagues have already made significant steps in creating prosthetic prototypes which integrate synthetic skin and are capable of making very sensitive pressure measurements. Those measurements mean the prosthetic hand is capable of performing challenging tasks like properly gripping soft materials, which other prosthetics can struggle with. They are also using innovative 3D printing strategies to build more affordable sensitive prosthetic limbs, including the formation of a very active student club called “Helping Hands”.

The new skin requires just 20 nanowatts of power per square centimetre, which is easily met even by the poorest-quality photovoltaic cells currently available on the market. And while energy generated by the skin’s photovoltaic cells cannot be stored yet, the team are already looking into ways to divert unused energy into batteries, allowing the energy to be used as and when it is required.

Dr Dahiya said, “The other next step for us is to further develop the power-generation technology which underpins this research and use it to power the motors which drive the prosthetic hand itself. This could allow the creation of an entirely energy-autonomous prosthetic limb.”

Ozone layer recovery could be delayed by a rise in a gas commonly used in paint strippers

If the recent, and rapid, increase in the use of a chemical called dichloromethane continues the recovery of the ozone hole could be delayed by up to 30 years, say researchers. The ozone layer shields Earth's surface from certain wavelengths of harmful solar ultraviolet radiation that would otherwise be detrimental to human, animal and plant health. NERC's British Antarctic Survey has invested over £14 million in ozone monitoring since 1957, and NERC has funded on average £1·5 million on ozone research every year since 2004.



Antarctic ozone hole: 1979 to 2008. (NASA image courtesy of Goddard Space Flight Center)

The researcher's findings, published in the scientific journal *Nature Communications*, suggest that this previously ignored chemical may now be contributing to ozone depletion. Not controlled by the Montreal Protocol, dichloromethane may now need to be considered for further regulation to improve future predictions of ozone recovery. Dichloromethane is commonly used as a paint stripper and in the food industry to decaffeinate coffee and tea.

The Montreal Protocol is heralded by many as one of the most successful international agreements ever. Introduced in 1987, the agreement followed many decades of monitoring of the ozone hole over Antarctica by researchers at NERC's British Antarctic Survey.

The agreement led to the regulation of emissions of ozone-depleting gases, after which stratospheric ozone began to recover. The ozone hole, which is largest around October every year, is projected to return to pre-1980 levels in the second-half of this century, and fully recover sometime between 2046 and 2057.

"While ozone depletion from dichloromethane is currently quite modest, it is uncertain how the amount of this gas in the atmosphere will change in the future. Our results show that continued sustained growth in its concentration could substantially delay recovery of the ozone layer, offsetting some of the future benefits of the Montreal Protocol." – Dr Ryan Hossaini of Lancaster University

Dr Hossaini and colleagues used sophisticated computer models of the atmosphere to show that the gas's effect on ozone has increased significantly in recent years. They also analysed measurements of dichloromethane in the atmosphere over the past two decades, provided by scientists from the National Oceanic & Atmospheric Administration (NOAA) in the United States.

Study co-author, Dr Stephen Montzka from NOAA said, "The increases observed for dichloromethane from our measurements are striking and unexpected; concentrations had been decreasing slowly in the late 1990s, but since the early 2000s have increased by about a factor of two at sites throughout the globe. It is uncertain what is driving this growth. However, it could be related to increased use of this chemical as a solvent in place of other long-lived chemicals (for example CFCs and hydrochlorofluorocarbons) that have been phased out, or from use as feedstock in the production of other chemicals."

The researchers' projections show that continued dichloromethane increases at the average trend seen from 2004 to 2014 would delay ozone recovery over Antarctica by 30 years. If dichloromethane concentrations stay at current levels, the delay in recovery would be only five years. Although the future trajectory of dichloromethane is uncertain, without any regulations on emissions, it is likely concentrations will fall somewhere in between these ranges.

Chartered Scientist
Registered Scientist
Registered Practitioner
Registered Science Technician
IST CPD Award

Technical Professionals

The Institute of Science and Technology has been supporting specialists with the technical skills that the world's economy needs for more than 60 years. Our membership is diverse, consisting of all sorts of technical experts, and managers wherever they work: from science labs and engineering facilities to recording studios and IT departments.

Central to IST's aims is the belief that people who work in technical roles deserve formal recognition for the work that they do, the experience they've racked up and the expertise they have to share. We encourage our members to further their careers by pursuing professional and personal development, and by attaining a professional status that recognises the value of their experience and expertise.

We know that our members are skilled professionals, and as one of the Science Council's Licenced Bodies we can give experienced technicians official accreditation through awarding Chartered Scientist (CSci), Registered Scientist (RSci), or Registered Science Technician (RSciTech) status. For those technical people working outside of science we are able to award Registered Practicioner (MIScT(Reg) or FIScT(Reg).

To register, you simply need to show that you have, and use, the skills that qualify for professional status, while always continuing with your professional development. A full explanation of what you need to do to get registered status can be found on the IST website: **istonline.org.uk/professional-registration**

In addition, the IST is running workshops in different organisations to explain the application process in more detail. If you are interested in one of these workshops, and there is enough interest where you work, email **office@istonline.org.uk**

You can also meet some of the people who have registered so far by visiting our website: **istonline.org.uk/professional-registration/case-studies**

Our work with organisations such as HEaTED and unionlearn, promotes the professional development of technical staff in all areas. Together, we are ensuring people working in technical roles get the support and opportunities they need to achieve their potential. There is advice and guidance available for IST members (particularly new or young ones) through the IST's Mentoring Support Network.

We know how important it is for people who work in technical roles to be able to develop their skills and have their expertise recognised. We know too, as we look to the future, that many more highly skilled technical people are needed. That's why the IST has dedicated itself to continuing to raise the status of specialist, technical, and managerial staff and to continue to support their progression.

The number of skilled technical people joining the IST's registration scheme is growing fast. That's because more and more of our members are discovering the great benefits and opportunities that professional recognition can bring.

The IST is an organisation run by technical people for technical people.

Leading Your Technical Team

"Delivering the fundamental and key elements for leading and managing people"

Leading Your Technical Team & Building on Your Leadership Skills

The Leading Your Technical Team programme set of **Leading Your Technical Team** and **Building on Your Leadership Skills** is geared toward delivering the fundamental and key skill elements for leading and managing people, particularly in a technical team.

The nature of technical support in many universities and higher education colleges is changing. People who work in a technical role have become both increasingly specialised and also high impact in terms of directly supporting teaching, research or infrastructure. Recent surveys have shown that high quality technical support is now seen as essential in delivering a high value student experience and quality research.

For many organisations one of the key challenges is how to effectively channel, develop and manage their highly valuable technical resource. Increasingly, what has been highlighted when realigning and grouping together technical support is the need to prepare and train people to manage, and above all, lead technical teams. We have designed the Leading Your Technical Team programme set to meet this need.

Both LYTT and BYLS are delivered in the context of a higher education technical environment, but they are not aimed at any specific job role or discipline. Our participants come from a very broad range of higher education institutions, and from a very diverse range of academic disciplines and departments or service sections. For example our recent courses have included people from institutions such as Robert Gordon University, University of Manchester, University of Oxford, University of Birmingham, University of Bristol, University College Cork, and the Open University to name but a few. Similarly our participants also have a wide variety of job roles. These ranging for example from Technician, Senior Technician, Laboratory Manager, IT Network Team Leader, Workshop Manager, Geological Facilities Manager, Textile Workshop Manager and Bio-repository Manager.

Leading Your Technical Team has a long and well respected history. It has been running for over 30 years with more than 1,500 people having been through the programme over this time. The programme content has continued to adapt and develop in line with changes in HE and it continues to be held in very high regard by HE senior managers and staff developers. Its high reputation is maintained through delivering a very high standard of technical management training via experienced HE managers, in a practical context with the reality of managing in a university technical environment.

How the programme works: Both programmes follow a similar format, in that the learning is enhanced through informal participative sessions that include active discussion, exchange of ideas and delegate group work. There is no role playing.

Leading Your Technical Team

Specific programme goals

The programme introduces the fundamental building blocks of management and leadership specifically in the context of technical support in universities and higher education colleges. It provides an opportunity to look at the practical challenges of managing and supervising technical staff from both academic and service areas, as well as examining a range of essential management and leadership skills and techniques. The programme links practical leadership theories to dynamic team leading in context with the reality of managing in a technical university environment.

By the end of the programme participants will have:

- Identified the main management/leadership/ supervisory skills required of them within their own working environment.
- Reflected upon the practices and processes affecting management and leadership in technical units, sections and departments.
- Practised a number of leadership and management skills and identified ways to develop these skills further.
- Had an opportunity to share with presenters and fellow participants from a wide number of universities and higher education colleges, their views, experiences, expertise etc.

Content

The programme will cover topics including:

- Key issues – roles and responsibilities.
- Management v leadership.
- Motivation and delegation – individuals and team.
- Communication skills & team briefing.
- Influencing skills and analysing your network.
- Managing and leading your team through change.
- People management issues & case studies.
- Positive team leadership

Who should attend

This programme is intended for people who now or in the future have managerial or supervisory responsibilities and are interested in developing their fundamental management and leadership skills . The programme content is delivered within the context of working in an HE environment and will be applicable to support staff from academic, research, and service areas. It is most important that participants are, wherever possible, residential and therefore available to attend the programme throughout.

There are a strictly limited number of places and applicants are advised to apply early in order to secure a place.

Additional dates, bespoke courses:

We would be happy to discuss running these courses at your host institution or at a suitable venue, if a number of attendees from a single institution wish to undertake the courses. Please contact Wendy Mason.

Building on Your Leadership Skills

Specific programme goals

The programme builds on the fundamentals learned in Leading Your Technical Team and provides a further opportunity to look at the practical challenges of managing or supervising technical staff from both academic and service areas, as well as examining a range of essential management and leadership skills and techniques. The programme again links practical leadership theories to dynamic team leading in context with the reality of managing in a technical environment. The programme content incorporates a range of topics that were suggested by attendees on LYTT as areas that they would most like to explore further, e.g. Managing Staff Performance, Dealing with Difficult People, and Influencing Skills. Toward the end of the programme we begin to explore the topic of Leadership Intelligences, which introduces you to themes covered in greater depth in more advanced leadership programmes.

By the end of the programme participants will have explored how to:

- Lead and motivate by identifying the key skills and characteristics of successful leaders and to develop the key people management skills you need to ensure success.
- Improve performance through developing personal strategies for enhancing the effectiveness of your team by using flexibility across the leadership styles.
- Manage performance through developing your team's strengths by setting and reaching both personal and team objectives using delegation and leadership skills.
- Lead a team made up of different personalities and encourage mutual respect and cooperation from all team members and understand how to overcome barriers to communication.
- Work with difficult people through resolving conflict and dealing with difficult people and situations confidently and positively.
- Understand yourself, your influencing environment and your impact and to develop multidirectional influencing skills and an influencing strategy.

Content

The programme will cover topics including:

- Leadership & motivation – The differences of motivation, influence and manipulation.
- Managing performance – Where and when to improve team and/or individuals performance.
- Working with difficult people – How to take control & case studies.
- Influencing – Influencing teams & influencing individuals.
- Leadership intelligences – Personality based leadership, leadership and team performance.

Who should attend

This programme is particularly suited to people who have completed Leading Your Technical Team or those who have previously attended similar programmes and

have a few years' experience in a technical managerial or supervisory role and want to further develop their management and leadership skills. The programme content will be delivered within the context of working in a university environment and will be applicable to support staff from academic and service areas.
It is most important that participants are, wherever possible, residential and therefore available to attend the programme throughout.

There are a strictly limited number of places and applicants are advised to apply early in order to secure a place.

Additional dates, bespoke courses:

We would be happy to discuss running these courses at your host institution or at a suitable venue, if a number of attendees from a single institution wish to undertake the courses. Please contact Wendy Mason.

Deligate feedback

Leading Your Technical Team

"I have learned more about the supervisory skills that I require in my job, how to develop these skills and especially in the way I communicate to other members of staff. I really enjoyed sharing views and experiences with fellow participants from other universities."

"I was able to learn the skills to solve some of the problems which I am facing myself in my leadership role."

"This course is well structured and presented. It thought me to look at my management technique and to focus my efforts on areas where I can succeed"

"Good course that hits a lot of the main areas and interesting areas regarding management and team leadership. It's motivational to the point that you return to work with more ideas and your own motivation to tackle day to day leadership."

"For me the course was a positive experience and directly related to my day to day working life."

"It was useful to find that many people are in the same position with the same worries and the programme provided useful information on dealing with many of our issues."

Building on Your Leadership Skills

"A Different way of looking at the way I respond to my team to improve all our performances. A way of understanding the individual members of my team. A chance to discuss with people from different institutions and areas of work how they deal with difficult members of their teams."

"Felt I came away from the course feeling better about being a team leader and focusing on management issues."

"A fun and informative way of helping me explore my leadership skills and how they affect my team."

"The course was very informative and inspirational with lots of ideas and discussions throughout the sessions. A very useful programme delivered in a fun relaxed environment."

"A very relaxed and informative course with like-minded delegates; the course was inclusive and challenged delegate with thought provoking ideas and concepts."

"Interaction and problems experienced between people across the HE spectrum away from your place of work is of great value and should not be forgotten. In-house training is not necessarily the way forward."

Presenter profiles

Kevin is the Programme Director for the LYTT & BYLS courses, which are now run through the Institute of Science & Technology (IST). He is the Resources & Operations manager of the Department of Infection, Immunity & Cardiovascular Disease within the Medical School at the University of Sheffield. He began his career at Sheffield as a trainee Medical Laboratory Scientific Officer over 35 years ago and has subsequently experienced a series of diverse technical roles within the School. Over the last 10 years he has undertaken a range of senior managerial positions, leading technical and support staff teams, under various administrations and has been involved with small and large project teams across the University. Kevin is also actively involved in both promoting and delivering staff development and training at Sheffield.

Lisa has significant experience managing large teams in both private and public sector organisations. After graduating from Loughborough University she worked for airport operator BAAplc in a variety of operational, change management and training roles across all the London airports. Whilst with BAA she also gained her MBA from the University of Surrey. In 2000 Lisa moved with her family to the USA where she undertook volunteer work which included the American Red Cross and the Small Business Administration in Texas. Lisa joined the University of Sheffield in 2005 and currently manages a team of 400+ staff in her role as Head of Campus Services.

For dates, venues, and to book a place on either of these programmes please contact:

Wendy Mason,
LYTT & BYLS Programme Administrator
T: 0114 276 3197 E: office@istonline.org.uk

IST
Conference 2018

The IST One-day Technical Conference 2018

Date: September 2018 Venue: Newcastle

This exciting one-day conference, it's talks and workshops, offer you an opportunity to update your technical knowledge, skills, and further your career development. It will also provide valuable networking opportunities, a chance to engage and learn from other technical staff, technical supervisors, and managers.

Target participants

The conference will be of specific interest to a wide group of specialist, technical, and managerial colleagues who work in a broad range of environments such as science, engineering, arts, industry, local authorities, schools, FE, HE, health facilities, and government departments.
The conference also provides opportunities for you to actively participate through poster presentations, and visits to supplier and manufacturer stands.

For professionally registered delegates (RSciTech, RSci, CSci, and also those delegates considering applying for professional registration) the conference's talks and workshops will contribute significantly to your professional and personal development.

The conference programme will include two keynote speakers, plus 15 talks and workshops organised in three parallel sessions throughout the day. This means you that can choose from 5 exciting topics in each session.

The full programme of workshops will be available on our web page in spring 2018.
The booking form will be available soon on our web site **istonline.org.uk**
To book and secure your place please contact Wendy Mason:
E: wendymason@istonline.org.uk T: 0114 276 3197

Technicians Make it Happen

Technicians are the lynchpin of our economy and yet we continue to face a chronic technical skills shortage in the UK.

Technicians Make it Happen seeks to inspire the nation's next generation of makers and creators and celebrate the 1.5 million technicians working across the UK.

Front cover

Dhanisha (Laboratory Technician): For Dhanisha, being a lab technician is more than a career; it's a state of mind.

Alan (orthotics technician): Thanks to an apprenticeship, Alan's helping people with lifelong medical conditions.

Inside front cover

At school, Helen hated public speaking. Now she's teaching her own classes.

Back cover

Liam (test engineer): Liam wanted to be a Test Engineer. Now he's working on Europe's biggest test chamber at the Science and Technology Facilities Council's RAL Space.

Sophy (welding technician): Sophy used to fix go karts. Now she's' moved onto much bigger things.

Inside back cover

Brian's involved in a UK-wide project to install smart meters in every home.

Images credit: Technicians Make it Happen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