Production: touchpointdesign.co.uk

The Official Journal of the Institute of Science & Technology

The Professional Body for Specialist, Technical and Managerial Staff

ISSN 2040-1868

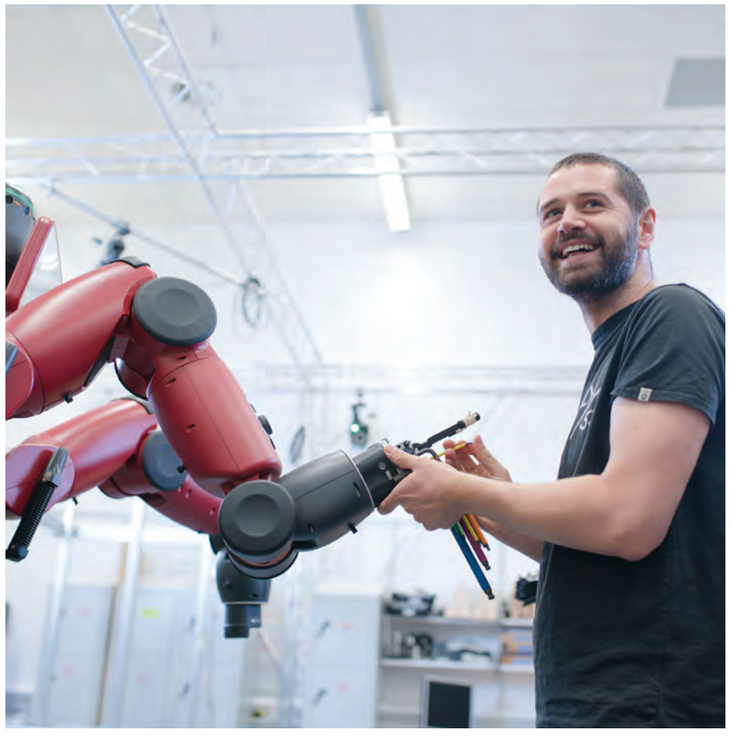
Kingfisher House, 90 Rockingham Street
Sheffield S1 4EB

T: 0114 276 3197 office@istonline.org.uk
F: 0114 272 6354 www.istonline.org.uk

IST

The Institute of Science & Technology

The Professional Body for Technical, Specialist, and Managerial Staff



The Journal

Winter 2018

Contents

The Journal

The Official Journal of
The Institute of Science & Technology

Winter 2018

The Professional Body for Technical,
Specialist, and Managerial Staff

ISSN 2040-1868

Editor's welcome

Welcome to the 2018 winter edition of the IST Journal.

Ian Moulson FISCT
IST Vice President,
Journal Editor

My thanks go to our contributing authors, and also once again to **Technicians Make it Happen** for some more great photographs and examples of real life technicians. We would love to hear about you and your technician journey, or your work, or your interests – so please do get in touch and tell us about it.

The technician world is very varied and diverse, and I know our readers find it extremely interesting to learn what their fellow colleagues make, or grow, or design, or measure, or check, or programme, or fix, or create. Tell us about what you do.

The cliché "Technicians don't get out much" is often said in jest, but it can have an unfortunate ring of truth about it. This is understandable in a way, given the pressures of work that so many technicians can face nowadays. But, the one sure-fire-way to get out more is by attending our IST annual one-day conference. It is a great opportunity to meet, mix, and network with colleague technicians, and to enjoy really top class keynote speakers and first class technical workshops and talks.

In this edition you can read about our recent conference that we held in Newcastle, in September of this year. Next year we are holding it in Birmingham. Take a look at our website for more details **istonline.org.uk/ist-conference-19-18th-september-birmingham/**

And save the date:

IST One-day Technical Conference 2019
Birmingham Conference and Events Centre
Wednesday 18th September 2019

Back issues (from 2006) of our bi-annual publication of The Journal have now been converted so that they are viewable online in pdf format. Some of the files are quite large, so calling up individual Journals may take a minute or two to load. See our web page **istonline.org.uk/resources/ist-journal-publication/**

We have also started to publish a small selection of the Journal items in our **blog articles section**, along with some additional guest articles, so why not visit that section and see what we have.

If you are interested in publishing in our Journal or in our blog articles section we would be happy to hear from you, please email **office@istonline.org.uk**

Lastly, remember to make sure that you check out the IST's regular e-Newsletter to get up to date news on what is happening in the technician community. Subscribe free at **istonline.org.uk** and follow the links to a series of periodic newsletters that we generate quarterly – please feel free to browse our newsletters and see what we have been doing and what we have planned for the near future.

We are happy to include short articles and news items in the IST's e-Newsletter that you feel would be of interest to the technical community, or if you would like to promote a technician event. Please do get in touch with any of the editors below, or through our IST Office. E: office@istonline.org.uk

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

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

John-Paul Ashton
j.p.ashton@istonline.org.uk

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

Ian

Chairman's view

Terry Croft, MBE, FIScT, CSci,
IST Chairman

Travelling around the UK at this time of year I see shops and advertising boards all promoting Christmas and the festivities. But, for the Executive and our teams, this is one of our busiest times of the year. Once the euphoria had died down following on from another successful conference (see this Journal edition and November eNewsletter #12) the team immediately started working on the 2019 conference. Keynote speakers, workshop presenters, and promotional material all has to be arranged quickly for the outline programme so we can open up for registration in early 2019. Team diaries are being prepared for commitments in 2019, ranging from delivering workshops on many subjects, including completing your professional registration application, to setting up your own company or institution's technical network. In addition, we have already been invited to a number of conferences and Technician events in 2019, where members of the team have been asked to be the keynote speaker at the event, and to provide workshops as well as being an exhibitor.

This of course is just a small part of the work we undertake on your behalf. Throughout the year team members are contributing to a variety of initiatives and reviews that are being undertaken nationally by major UK bodies. While also, at an individual member level, we are in constant touch with our members who have requested our help and support with issues that may be affecting them. We offer advice and support, and more importantly perhaps, the knowledge that there is always someone here to talk to in confidence.

Working across all sectors, team members are encouraging YOUR involvement in YOUR Professional Body. We want you to play an active part, to perhaps consider writing an article for the Journal or our Newsletter, to think about presenting a workshop to help or train others, or maybe find some time to support the busy IST back room team. Above all it is extremely important that You, as a member of the IST, have your say and freely give your views and opinions on how we work on your behalf, and help us to shape IST's future direction.

So why not become an active member. As a volunteer/not for profit professional body we want to continue to ensure that the IST is run by technicians for technicians.

If this is you then please contact me at **office@istonline.org.uk**

However, I now do have to return to Christmas, as this is the forerunner to the end of 2018. There are so many people (too many to name!) I wish to thank for all their hard work, contributions and commitment, freely given over the last 12 months ensuring that the IST remains the key professional body for so many professional technicians and other professionals across the length and breadth of the UK – from Arts and Media to Science, Medicine, and Engineering.

Thank you so much and I look forward to serving you and the Technical Community in 2019.

Terry

President's view

Helen Sharman
CMG, OBE, FRSC, FIScT
IST President

What will Brexit mean to you? Could your lab supplies be affected, either by the exchange rate or by a delay in deliveries? Will your teams be able to recruit sufficient technical staff?

Technicians can directly affect lab supplies with a bit of thought and planning; recruitment is more complex. Although EU technicians make up a smaller proportion of the technical workforce than the EU academics make up of academic positions in the UK, academics are more likely to get sponsorship in Tier 2 because of the salary threshold or because of the way the skills level of technical roles is classified. This makes it more important than ever to ensure that the skills required to do your role are recognised and formally documented.

Treat yourself to a personal review! Now is a time when many institutions will be considering where their future technical staff will come from, and what is needed to maintain the skills of the technical workforce. If you make sure your organisation is aware of the level of skills and training you use in your job, and the training needs you identify for yourself, you will not only be promoting your own career but you will be doing good for the technical profession, and ultimately for the country.

Tell us what is happening in your company or institution. Why not write a short piece or comment for our next eNewsletter. Interested? Then simply drop us an email at **E: office@istonline.org.uk** and we will get back to you.

Best wishes,
Helen

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:
office@istonline.org.uk – general enquiries
memberships@istonline.org.uk – enquiries regarding new memberships and renewals
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.

Social Media – We use social media routes for quick communications, networking and hope to encourage both members and non-members alike to engage in online discussions and provide ideas and feedback. The platforms that we use are:

Twitter (@istonline) – we encourage ideas, feedback, and discussions using **#istforum**
Facebook (@istonline.org.uk) – feedback, ideas and comments welcome
LinkedIn and Google+ – join in group discussions, links through to these groups (and our Twitter account and Facebook page) are available on our **website**.

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

IST Journal Publication

Back copies of our bi-annual journal publication are viewable online.

The Journal Back Issues
istonline.org.uk/ist-journal-publication

Article submissions for the IST Journal
The IST Journal is a quality biannual publication. Its style and content strongly reflect IST's unique standing as a professional body that has an extremely diverse and vibrant technical membership.

The Journal's informal style offers an opportunity for our members and guests to freely present and publish articles, papers and news items that would be of interest to our readership's varying expertise and extremely broad subject range. We do try to encourage articles to be written with our diverse technical membership in mind.

We positively welcome article submissions from all and any areas of technical interest, including areas such as IT, media, medicine and the arts. We like to cover existing, historical and new technological advances, and also unusual aspects of science or technology.

We particularly want to encourage technical people to publish for the first time, as part of their career development, and we can offer help and assistance in putting a first article together.

Contact
IST office: **office@istonline.org.uk**

We can provide subscriptions for hard copies of our Journal, rates for 2019 are as below. For further details please contact **(office@istonline.org.uk)**:

UK – £25 per year (2 editions per year)
EU – £40 per year (2 editions per year)
Non EU – £55 per year (2 editions per year)

The guidelines for article submissions to the IST Journal are:

1. Article submission deadlines for 2019/2020
   - Autumn/Winter edition is 1st September.
   - Spring/Summer edition is 1st March.

2. Your article should be submitted electronically in Microsoft Word .doc format; with its images supplied separately as JPEG files (it is important that all your article images have a minimum resolution of 300dpi. Images embedded in a Microsoft Word document are not usually reproducible to the necessary print resolution).

3. Short articles: these can be any length up to roughly 2,000 words.

4. Major articles: these are normally no longer than roughly 6,000 words. We can only publish one or two major articles per edition. Larger articles may need to be accommodated across two or more editions.

5. All articles should be written in UK English. This is important as, depending on the content size and quality of English, they can take up a lot of editing time. Some can require extensive re-writing. We may have to decline very poorly translated articles.

6. Editing – we will edit all articles into the IST Journal's house-style, and may have to correct for spelling and grammar. Text layout and images may need to be changed, altered, or omitted. Pease see "IST Journal house-style" description on our web site. It will help enormously if your article follows this style as much as possible.

7. Article submissions should be submitted via email to office@istonline.org.uk. Your email should clearly state "Journal Article Submission" and the article and separate images sent with it as email file attachments.

New members and registrations

New members April 2018 – November 2018

Membership No.	Name	Grade
T15979	Ms C Barron	MIScT
T15980	Mr A E Ajulo	MIScT
T15981	Mr N Saunders	MIScT
T15982	Mrs J C Arnold	MIScT
T15983	Mr E Michellis	MIScT
T15984	Miss L Butler	MIScT
T15985	Ms A Jimenez-Valverde	MIScT
T15986	Mr W Woodside	MIScT
T15987	Mr D J Bottrill	MIScT
T15988	Mr R H Dickinson	MIScT
T15989	Miss S H Kofarbai	AssocIScT
T15990	Dr K J Burgess	MIScT
T15991	Mr N Bethune	MIScT
T15992	Mr C Kerr	MIScT
T15993	Mrs E Lee	MIScT
T15994	Mrs M Louis	MIScT
T15995	Mr S O'Rourke	MIScT
T15996	Mrs P H McAdam	MIScT
T15997	Mr G R Paterson	MIScT
T15998	Mrs C Powell	MIScT
T15999	Mr K J Rigler	MIScT
T16000	Dr D Wiredu Boakye	MIScT
T16001	Mr J Amaechi	MIScT
T16002	Mr G Yeo	MIScT
T16003	Mr R S Wood	MIScT
T16004	Mr D L Pulford	AssocIScT
T16005	Mr I P Griffin	MIScT
T16006	Mrs S Milosevic	MIScT
T16007	Ms W Cheng	MIScT
T16008	Mr T L Adams	MIScT
T16009	Dr S K Tyagi	MIScT
T16010	Dr G J Calverley	MIScT
T16011	Mr A S Iloke	MIScT
T16012	Mr U Umunnakwe	MIScT
T16013	Miss C Tuckey	MIScT
T16014	Mr A A Omori	MIScT
T16015	Mr S CCripps	MIScT
T16016	Dr J W Wood	MIScT
T16017	Mr A Khan	MIScT
T16019	Mrs L Wright	MIScT
T16020	Dr H F Stanyon	MIScT
T16021	Mrs I E Effiong	MIScT
T16022	Miss S Chipper-Keating	MIScT
T16023	Ms A Dolling	MIScT
T16024	Ms M Sroya	MIScT
T16025	Dr S Bagstaff	MIScT
T16026	Mr R Patel	MIScT

Membership No.	Name	Grade
T16027	Mr N Ashley	MIScT
T16028	Mrs C F Chuks	MIScT
T16029	Mr P Watson	MIScT
T16030	Mrs K A Rimmer	MIScT
T16031	Mr A C Jones	MIScT
T16032	Dr P J Wilkinson	MIScT
T16033	Dr R Johnson	MIScT
T16034	Mr N French	MIScT
T16035	Mr M D West	MIScT
T16036	Mr C Wright	MIScT
T16037	Miss A J Hayton	MIScT
T16038	Miss K R Melvin	MIScT
T16039	Mr D M Yeadon	MIScT
T16040	Ms E Chapman	MIScT
T16041	Mr S Adamu	MIScT
T16042	Dr S Challa	MIScT
T16043	Dr J A Barker	MIScT
T16064	Mr C Turley	MIScT
T16065	Mrs M Puranik	MIScT
T16066	Miss D Gabell-Jopson	MIScT
T16067	Mr B O Oladeji	MIScT
T16068	Mr S Weston	MIScT
T16069	Dr J J Barnes	MIScT
T16070	Ms R Garcia Vigo	MIScT
T16071	Mrs M Beck	MIScT
T16072	Ms R Lancaster	MIScT
T16073	Mr G Jarman	MIScT
T16074	Mr C P Owen	MIScT
T16075	Mrs L C Hudson	MIScT
T16076	Mr M Lovett	MIScT
T16077	Ms H R Evans	MIScT
T16079	Mrs S Gaunt	MIScT
T16080	Dr K Wicks	MIScT
T16081	Mr P J Whiting	MIScT
T16082	Dr P Rocha	MIScT
T16083	Mr P Willis	MIScT
T16084	Mr M Santonastaso	MIScT
T16085	Dr J Wood	MIScT
T16086	Dr W Y Mung	MIScT
T16087	Miss L Burnett	MIScT
T16089	Dr J Cartwright	MIScT
T16090	Dr K E Birch	MIScT
T16091	Mr S C Gadge	MIScT
T16092	Mrs R Summerfield	MIScT
T16093	Ms J Newport	MIScT
T16094	Dr B J Kirby	MIScT
T16095	Mr J Holmes	MIScT
T16096	Dr C J Ireland	MIScT
T16097	Dr P H K Leung	MIScT
T16098	Miss R Morar	MIScT
T16099	Miss S Barber	MIScT
T16100	Mr B McNamara	MIScT
T16101	Mrs M C Moreno Rodriguez	MIScT
T16102	Miss E E Ekpenyong	AssocIScT
T16103	Miss Y N Beladaci	MIScT
T16104	Mr L Drezet	AssocIScT
T16105	Mr D J I Franklyne	MIScT
T16106	Mr S J Gibson	MIScT
T16107	Miss H Massey	AssocIScT
T16108	Mr S Mikula	MIScT
T16109	Mr T P Peace	AssocIScT
T16110	Mr C Smith	AssocIScT
T16111	Mrs C Whalley	MIScT
T16112	Miss C Woodcock	MIScT
T16113	Mr R Kelly	MIScT
T16114	Mr P R Ashford	MIScT
T16115	Mjr(Retd) A Churchill	FIScT

Total: 114

Science Council Registrations

Membership No.	Name	Grade
	Ms J R Barkans	CSci
T15453	Dr M Hodges	CSci
T15718	Dr M P Ariaans	CSci
T15964	Dr K Maniam	CSci
T15967	Dr C Jarrett	CSci
T16001	Mr J Amaechi	CSci
T16029	Mr P Watson	CSci
T16032	Dr P J Wilkinson	CSci
T16069	Dr J J Barnes	CSci
T16081	Mr P J Whiting	CSci
T16082	Dr P Rocha	CSci
T16090	Dr K E Birch	CSci
T16100	Mr B McNamara	CSci
T15313	Mr P J M Gallimore	RSci
T15725	Miss K Hopkinson	RSci
T15753	Dr A J Connelly	RSci
T15786	Miss A Lesiuk	RSci
T15787	Mr M P Dorna	RSci
T15796	Mr J Alker	RSci
T15898	Mrs C Bresner	RSci
T15931	Mrs T Oughton	RSci
T15933	Dr J Lockley	RSci
T15981	Mr N Saunders	RSci
T16000	Dr D Wiredu Boakye	RSci
T16008	Mr T L Adams	RSci
T16022	Miss S Chipper-Keating	RSci
T16033	Dr R Johnson	RSci
T16036	Mr C Wright	RSci
T16065	Mrs M Puranik	RSci
T16066	Miss D Gabell-Jopson	RSci
T16080	Dr K Wicks	RSci
T16083	Mr P Willis	RSci
T16084	Mr M Santonastaso	RSci
T16091	Mr S C Gadge	RSci
T16092	Mrs R Summerfield	RSci
T16098	Miss R Morar	RSci
T16099	Miss S Barber	RSci
T15368	Mr M B Bell	RSciTech
T15642	Mr M Haigh	RSciTech
T15804	Miss G E Bradshaw	RSciTech
T15879	Mrs I Baleanu	RSciTech
T15949	Miss S J Viney	RSciTech
T15979	Ms C Barron	RSciTech
T15988	Mr R H Dickinson	RSciTech
T16002	Mr G Yeo	RSciTech
T16013	Miss C Tuckey	RSciTech
T16027	Mr N Ashley	RSciTech
T16064	Mr C Turley	RSciTech
T16068	Mr S Weston	RSciTech
T16085	Dr J Wood	RSciTech
T16087	Miss L Burnett	RSciTech
T16093	Ms J Newport	RSciTech
T16101	Mrs M C Moreno Rodriguez	RSciTech

Total: 53

IST Organisation

The Institute of Science & Technology is an independent body governed by an Executive Committee, members of which are elected by the Corporate Membership of the Institute. The Executive Committee elects Officers annually and each member will serve for a term of three years and has the right to stand for re-election at the end of their term of office. All Institute Officers are honorary.

The Executive

President:	Helen Sharman CMG OBE FRSC FISCT
Chairman:	Terry Croft MBE FISCT CSci
Secretary (and Public Relations Advisor):	Natalie Kennerley FISCT CSci
Finance Officer:	Joan Ward FISCT
Education Officer (and Chair of the Education Board):	Philippa Nobbs FISCT
Membership Development Officer (and Diversity & Equality Champion):	Kevin Oxley FISCT CSci
Marketing Officer (and Registrar):	Michelle Jackson FISCT CSci

The IST also receives valuable support/advice from a number of non-Executive members

Administrator	Wendy Mason
Champions Coordinator	John Dwyer FISCT CMI
China Liaison Advisor	Geoff Howell MISCT RSci
Fellowship/Overseas Advisor	Derek Sayers FISCT
Industry Liaison Advisor	James Trout FISCT CMgr RSci
Journal Editor	Ian Moulson FISCT
Social Media/Engagement Advisor	John-Paul Ashton MISCT RSci

The Education Board – Chaired by Philippa Nobbs

David Forster FISCT

Ian Gray MISCT

Geoff Howell MISCT RSci

Dr M Jackson FISCT CSci

Chris Pambou MISCT RSci

The Marketing Board – Chaired by Michelle Jackson

John-Paul Ashton MISCT RSci

Natalie Kennerley FISCT CSci

Kevin Oxley FISCT CSci

Joan Ward FISCT

The Editorial Board – Chaired by Ian Moulson

Kirsty Parkin (Assistant Editor)

Alan Gall FISCT, CSci (IST Archivist)

Stephen Gamble MISCT, FIBMS

Natalie Kennerley FISCT, CSci

Kevin Oxley FISCT, CSci

Joan Ward FISCT

Michelle Jackson FISCT, CSci

Vice Presidents

Maida Davidson FISCT

Terry Evans MISCT

Simon Fairnie FISCT

Ian Gray MISCT

Robert Hardwick FISCT

Ian Moulson FISCT

Derek Sayers FISCT

For further details and Executive member profiles please see the IST's web pages at **istonline.org.uk/about/organisation/**

IST Conference 2018 – Review

Joan Ward

Key sponsors:

On a cold and windy day back in September several intrepid travellers set off on their journeys to the North East, to prepare for the IST conference in Newcastle. Despite the combined efforts of the bad weather and British Rail to thwart the efforts of the travellers, they eventually arrived at the Crowne Plaza, Newcastle, several hours late and via unexpected routes.

Once checked into the hotel, work began to lay out the exhibition space, check name badges, prepare poster space and complete numerous other small organisational tasks.

The Hotel staff couldn't have been more helpful and soon it was time to wrap up for the evening and relax for a little while over an evening meal, and then retire in readiness for what promised to be an excellent event the next day – assuming, of course, that the storms abated overnight and allowed delegates to travel.

After a good night's rest, and with a 7.30 start on the 20th September, the final preparations for the IST Conference swung in action. Exhibitors and delegates started to arrive – some more windswept than others. Spirits were good, and delegates arrived in good numbers, the majority of the 290 who registered making it to the event – well done everyone! After a quick cuppa we were ready to start.

After a short welcome from our Chair, Terry Croft MBE, we were underway and our first Keynote speaker, Dr Kianoush Nazapour, currently a Reader in Biomedical Engineering at School of Engineering, Newcastle University, stepped up to deliver his presentation Star Wars, Terminator, Bionic Hands – Science Fiction or Reality? The session was, without a doubt fascinating, and much enjoyed, as can be seen from a few comments from the delegates:

"Loved the talk on Bionic hands and computer interface /Artificial intelligence it is cutting edge and practical"

"It's fabulous to learn about an area you wouldn't normally be familiar with and also the struggles that are encountered"

"The keynote sessions were both v interesting and inspiring! Sometimes it's good to be reminded why science is important and interesting!"

Following Dr Nazapour's session delegates broke into smaller groups to attend various workshop sessions:

- MotoE Electric Superbike – Miquel Gimeno-Fabra (University of Nottingham) and Robert Driver (Brunel University)
  "Fascinating and amazing to see a UK university competing with the world leader."
- Plastic – What is the Future? – Jon Harvey (The Environment Agency Plastics and Sustainability Team)
  "The talk centred on plastic pollution, but it did spark my thoughts about plastics, the starting point for thinking about how much single use plastics we use in our research and teaching activities, how can we reduce"
- Just in time learning: Using QR codes to bring digital resources to life in the fashion studio – Marie Slater & Kate Soper (Manchester Metropolitan University)
  "Very engaging and useful something I will definitely look at implementing in my own institution."
- A technician's eye view of the history of science – Andy Connelly (University of Leeds)
  "A very engaging and interesting talk which i felt was applicable to everyone in attendance."
- Centrifugation Clinic – Peter Rignall (Eppendorf)
  "The content of the talk was interesting & the speaker was friendly & welcoming"

After a busy and interesting start to the day a refreshment break was very welcome, and we headed to the exhibition hall for a cuppa and had a short visit to a couple of sponsors and a brief look at the posters. The number of posters submitted this year was more than expected, and it was great to see so many techs wanting to display their work. Although, there were too many to view in one visit to the poster area! Then, before we knew it, it was time to find our way to the next session.

The next group of workshops offered a great choice of topics, and most sessions were very well supported, so finding a good seat was a priority. The workshops included:

- CERN – working on the edge of technology – Raymond Veness (CERN)
  "This was very good and very tailored toward technicians. Very interesting to learn of Cern's reliance on technical staff"
- Our WorkFit Journey at the Environment Agency – Alison Thwaite & Tom Jackson (Environment Agency/Workfit)
  "Great talk by Alison. Loved the rapport between her and Luke. Have family member with DS and Workfit doing a great job and needs promoting/ touring to break down barriers and stereotypes."
- The history and ethics of laboratory animal research – Mark Ariaans (University of Sheffield)
  "Careful approach to direct material with considerable detail to inform an intelligent audience that may not be familiar with the origins and rationale for continuing use of animals in product testing."
- ULT Freezers and Sustainability – Peter Rignall (Eppendorf)
  "The presenter was knowledgeable, and I learnt a few things."
- Technical Staff Performance Management 'The First Conversation' – Mark McDonagh (Staffordshire University) & Paul Walsh (Manchester Metropolitan University)
  "Presenters engaging and knowledgeable, multi format workshop with video examples about difficult performance related conversations. Will be taking the advice on board and trying to use to aid the management of my team"

Phew – what a busy morning! Lunch followed, although unfortunately we had to queue for a little while, because of the high number of delegates (a note for next year's Conference organisers!). There was also plenty of time for another chance to connect with the sponsors and review the posters that had been submitted.

The posters were of a very high quality. The judges were, our President Helen Sharman CMG OBE, and Natalie Kennerley (IST Secretary), plus we were delighted that our Key Sponsors, CERN and Veolia joined the judging panel. After recharging our batteries, we were ready for the afternoon sessions.

The afternoon began with an excellent Keynote presentation from Prof Sir Doug Turnbull, Professor of Neurobiology at Newcastle University – "Diseases affecting the small circle of life", which was outstanding, with lots of positive feedback from our delegates.

"Really interesting keynote talk presented in a manner that was easy to understand by the whole scientific community."

"Progress has been amazing in this field, hopefully this will continue with the skills and expertise from all team members - clinical, technical and ethics."

"I especially found the talk on mitochondrial disease fascinating even though it is far removed from the area I work in."

Following on from the Keynote we learned who had won the Roger Dainty Poster Award. Roger was a much respected, inspirational Honorary Fellow of the IST who is much missed. The prize is awarded in his memory to acknowledge the great work done by the technical community. It was particularly gratifying to see so many posters having been submitted, which amply demonstrated the quality of the work done by technicians and technical specialists. We were

delighted that our President Helen Sharman CMG OBE, was available to present the prizes:

1st Prize David Race and colleagues, 2nd Prize Laura Hartshorne, 3rd Prize Matt Peake

Well done also to those who received commendations: Tyler Harvey-Colishaw, Chris Huggins, Claire Hutton, Rachael Jones and Julia Spoors.

After congratulating our poster winners, we were off to find our final workshop sessions, and these proved to be as popular, varied and interesting as our earlier ones:

- The Future of Technical Services: How to Make Friends and Influence People – Richard Cutting & Karen Henderson (Senior Technical Managers Network)
  "Great networking meeting, with registration of email addresses and signatures so that contact can be made."
- Professional Registration? At my age? – Frank Fletcher (University of Sheffield)
  "Interesting presentation of a personal career journey-very inspirational."
- CPD: A practical toolkit for building your portfolio – Jemma Walker (Birmingham Women's Hospital)
  "Interactive workshop, well presented, more information on how to more carefully reflect on what has been learnt from CPD activities"
- The Technician Commitment: A practical workshop on Technicians making it happen – Jon Kelly & Sarah McCafferty (University of Edinburgh)
  "It was good to hear other people's ideas and I went away with personal actions"
- Giving yourself a boost – how to feel valued for what you do – Charlotte Ashley-Roberts (Institute of Physics)
  "Interesting sectioned interactive approach with fairly deep questioning activities. Light touch considering the potential impact of the conversations it promoted."

There was just enough time left for a final cuppa and spot of networking before we headed into the final closing remarks from Ian Moulson (IST Vice President). There was widespread agreement that all the efforts to get to the Conference had been well worth it and we learned that Birmingham is the venue for the 2019 Conference – so we said goodbye to friends and colleagues and headed off on our respective journeys home, hoping that travel would be less eventful than the trip out!

A special thanks to our Key Sponsors, all our exhibitors, our Career Zone supporters for all their help, which is much appreciated – it was especially nice to see our nominated charity Down's Syndrome Association/ Workfit had been able to join us. Many thanks of course to all our delegates for making the Conference a great event – we're hoping to see as many of you as possible in Birmingham.

Key Sponsors of IST Technical Conference 2018:

Exhibitors at the IST Technical Conference 2018:

Career Zone Supporters at the IST Technical Conference 2018:

Art and Design
Social science
Medicine
Robotics
IT
Life sciences
Arts and Media
Psychology
Immunology

iST

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

Zoology
Earth sciences
Materials
Biology
Biomedical
Neuroscience
Marine biology
Physical sciences
Interdisciplinary
Engineering
Criminology
Graphic design
Applied science
Environmental
Healthcare
Food Technology
Chemistry
Music
Forensics
Software
Space sciences
Textiles Technology
Physics
AI

Application for IST membership

Membership

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.

Kevin Oxley FIScT, CSci IST Membership Development Officer

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/)**.

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.

The IST's UK membership hot-spots

Annual membership fees are:

- Junior: £10
- Affiliate: £22
- Associate: £38
- Member: £49
- Fellow: £63

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

** Please note that IST membership subscriptions of employees are eligible for UK tax relief, under Section 344 of the Income Tax (Earnings and Pensions) Act 2003. Claims needs to be made by members individually directly via HMRC

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 be made online.

Caroline Herschel: technician to the stars

Andy Connelly

Short biography: Caroline Herschel (1750-1848) was an assistant to her brother William Herschel and a successful comet hunter in her own right. She was the first salaried female in the history of astronomy.

Caroline Herschel blazed a trail as the first salaried female in the history of astronomy. She gained fame in the 18th century as an assistant to her brother, the astronomer William Herschel, and later independent acclaim as a comet searcher. She was not the first technician drawn, initially reluctantly, from a famous astronomer's family. Some years earlier, the wife of the first Astronomer Royal, Margaret Flamsteed, was also drafted in by her husband John to help with observations. However, where Margaret had a limited role in her husband's work, advances in technology and Caroline's burning desire for independence allowed Caroline to create a career for herself. The path to that career was not an easy one; hers was a turbulent life and one in which happiness was as difficult to find as the comets for which she hunted.

Figure 1: Caroline Herschel (1750-1848)

Caroline was born on 16th March 1750 into a working-class family and for the first 21 years of her life had little prospect of independence. Her hardworking and artistic father, Isaac, encouraged all his children to learn musical instruments and Caroline's four brothers all became accomplished musicians. The second son, William, even followed his father into the Hanoverian Guards as a bandsman. However, Isaac's attempts to teach Caroline music were overruled by her mother, Anna.

Caroline's older sister had followed the typical career path of a working-class girl by going into service in a middle-class household. Unfortunately for Caroline, Anna liked the idea of having her youngest daughter as an unpaid servant, and so denied Caroline all opportunities to develop beyond basic schooling and the limited skills required at home such as basic knitting and linen-making. Caroline later wrote, "... all my father could do for me was to indulge me (and please himself) sometimes with a short lesson on the Violin; when my Mother was either in good humour or out of the way."[1].

Escape through marriage was also unlikely for Caroline. A combination of scars caused by childhood smallpox and her small stature – she was less than 5ft in adulthood – meant that even her supportive father warned her against thoughts of marriage. An extensive diarist throughout her life, she recorded her father's warning in her notebooks: "as I was neither handsome nor rich it was not likely that anyone would make me an offer, till perhaps when far advanced in life some old man might take me for my good qualities."[1] Caroline felt that she was the Aschenbrödel [Cinderella] of the family.

The Invasion of Hanover by the French in 1757 would end up being an important event in Caroline's life – even though she was only 7 at the time. The Hanoverian guard were defeated at the Battle of Hastenbeck forcing William, then aged 18, to flee to England. Fortunately, William made a success of his escape and after initially struggling to make a living as a concert performer, teacher, and composer William found a role, in 1766, as the organist at the fashionable Octagon Chapel in Bath. Five years later, William suggested that Caroline join him there. Caroline wrote that William proposed, "to make a trial, if by his instruction I might not become a useful singer for his winter Concerts and Oratorios?"[1] To release Caroline, William had to give Anna money to pay for a domestic servant.

On their night time journey to England, William talked of nothing but the constellations. It was the first clue, if Caroline had realised it at the time, that William was becoming obsessed with astronomy and that her true future lay in the stars above not as a star of the stage.

She arrived in England in 1973 aged 22, with no experience as a professional musician and speaking no English. William's busy musical career and all-consuming hobby of astronomy reduced their interactions to breakfast-time lessons in household arithmetic, English, and singing. She was expected to run the household, fitting her singing practice in where she could. It was a lonely existence, but she was free of Anna and had a chance of independence. With characteristic determination, she made rapid progress and by 1776 her English had improved enough to allow her to assist William in preparing the treble singers for concerts, performing in concerts, and undertaking the time-consuming (and unpaid) role of copying sheet music.

Only five years after arriving in Bath, in 1777, Caroline sang as a soloist in the Easter oratorios with William conducting. The next year she sang solos from Handel's Messiah with such success that she was invited to repeat her performance in Birmingham. She refused, perhaps out of a sense of duty to her brother or a lack of confidence, preferring not to leave the protection of her brother as choir master. Whatever the reason, she turned down her only real chance to achieve independence as a musician.

At the NEW ROOMS,

On WEDNESDAY the 15th of *April*, 1778.

WILL BE

Mr. HERSCHEL's Benefit-Concert:

The MUSIC taken from the

SACRED ORATORIO

OF THE

MESSIAH.

The Principal VOCAL PARTS

By Miſs HERSCHEL, Miſs CANTELO, *aſſiſted by Mrs. Harris*

Mr. BRETT, Mr. WILSON, & Mr. HERSCHEL.

The FIRST VIOLIN

By Mr. BROOKS, Junior.

☞ *With a Full Chorus of additional Voices and Inſtruments.*

N. B. To begin a Quarter before SEVEN o'Clock.

TICKETS at Five Shillings each to be had of Mr. HERSCHEL, No. 19, *New-King-Street*, BATH, and at the Rooms, *&c.*

Printed by W. GYE, in Wellgate-Buildings, BATH.

Figure 2: Poster advertising Handel's Messiah. Caroline appears as first soloist above the well-known Miss Cantelo. Herschel Family Archives[1]

By that time, the Herschel home had already become an astronomer's workshop and Caroline was expected to help. Her first role was making pasteboard tubes to hold the lenses for simple refracting telescopes. However, William's obsession was to be able see things that no other observers had seen so Caroline was soon grinding horse dung to make mirror moulds used in the production of powerful reflecting telescopes. She would also read to her brother while he spent long hours polishing those mirrors and even spoon feed him like a baby so that he didn't ruin the polish by stopping. She wrote of this time, "I became in time a useful member of the workshop as a boy might be to his master in the first year of his apprenticeship."[2]

In 1776, William lost his position as organist in the Octagon Chapel - due in part to his obsession with astronomy. This meant that opportunities for Caroline diminished rapidly; her last concert as a soloist was on Whitsunday in 1782 at the age of 32. However, William's telescopes had attracted many scientific admirers and some great early discoveries which catapulted him into a new life. It was his discovery of Uranus in 1781 that won him the patronage of King George III and started him on a career path that would see him become one of the greatest observational astronomers of all time.

In 1782, William moved to a house in Datchet near Windsor and took it for granted that Caroline would abandon her career, run his house, and act as his assistant. She was initially reluctant in this role, annoyed that she was now expected to spend her nights in the cold and wet outside looking through a telescope alongside running the house. Whether it was that Datchet was such a dull place, or that William went about properly teaching Caroline the skills of an astronomical assistant, she began to embrace her new role.

William had made Caroline her own telescope and instructed her to sweep the sky and record unusual objects such as double stars, comets, or nebulae, checking them against existing catalogues. The astronomical world at the time was obsessed by nebulae, so when Caroline started finding these with her small telescope brother and sister were excited. However, the French comet-hunting astronomer Charles Messier had already set down many nebulae and it was not until the evening of 26th February 1783 that Caroline came across a nebula which was unknown to science. She excitedly recorded in her notes: "Messier has it not." This sparked William into a search for nebulae with his powerful new 20ft reflecting telescope.

William found that he could not do these searches alone and for the rest of the 1780s, William swept for nebulae and Caroline recorded what he saw. The next day Caroline would write up a fair copy of the night's work, alongside polishing mirrors, winding clocks, writing down memorandums, and fetching and carrying instruments working with William's other assistants. All this work meant she struggled to find time for her own sweeping.

She grabbed every opportunity open to her to continue her own work. In 1786, Caroline, aged 36, was stuck at

home while William was away delivering a telescope in Germany. Between looking after the many uninvited-visitors who came to look through the telescopes, she pursued her own sweeping and discovered her first comet. Given the timing between the American and French revolutions, this must have been an important British scientific victory and William returned to England to find Caroline the centre of attention, both among the Royal Family at Windsor Castle and within English scientific circles. These years assisting William were productive and unusually happy years for Caroline and she supposed they would last for as many years as William continued in good health. This was not, however, to be.

In 1787, William was awarded £2000 to continue work on his giant 40ft telescope. As part of this award, Caroline wrote that King George III added, "a salary of 50 pounds per year was settled on me as an assistant to my Brother. [Footnote: Exactly the sum I saved my brother at Bath in writing Music by a clean fireside.]"[2] Caroline had her independence, even if she'd had asked William to request this addition. The timing of this request cannot have been accidental as William married the widow Mary Pitt the following year.

William's burgeoning relationship with Mary had been reducing the amount of time Caroline spent assisting William for the previous few years. Worse, in 1790, William solved what was for him the main riddle of the nebulae. Such was the power of his telescopes, he could show that some nebulae were clusters of stars while others were clouds from which stars might be born. This meant that William's enthusiasm for late night observations diminished sharply and so Caroline's role as William's assistant was now greatly reduced. This was difficult for Caroline as it also left her without an outlet for her energies.

Figure 3: Etching dated February 1790 showing "The Female Philosopher smelling out the Comet". Caroline had discovered a comet the previous month. From a private collection. [1]

She used the time she had to search for comets and over the next decade she discovered eight comets, five of which were unknown to science. This put her third in the comet hunting league at the end of the 18th century behind two French male astronomers and she appeared in the popular press, not all together flatteringly, as "The Female Philosopher smelling out the Comet". More happily, other astronomers seem to have treated Caroline as a professional colleague, if also something of a curiosity. She became friends with the Astronomer Royal Nevil Maskelyne and in a letter to him she revealed how much comet hunting meant to her, saying "I have no other means… of proving myself in the land of the living."[3]

Something happened between William, Mary, and Caroline in 1797 after the discovery of Caroline's eighth comet. The details are lost to us but the event led to Caroline quitting her cottage next to the Herschel home and moving into very basic lodgings with one of William's other assistants and his wife. From there she moved repeatedly, not staying anywhere for long, and struggled to find opportunities for observing. She was, however, far from inactive. In 1798, the Royal Society published her updated British catalogue of stars. It was a monumental effort requiring enormous dedication and flawless accuracy. It contained almost 3000 stars of which Caroline and William had together contributed nearly 600. Despite this success, Caroline became lonely and frustrated by the lack of employment and she began to plan a return to Hanover.

William died in 1822 and with the end of his life, Caroline ended her time in England. Aged 72, she left England with fond farewells, but did not retire from astronomy as she kept track of astronomical discoveries and took great joy in creating a full catalogue of the 2500 nebulae then known – an achievement that gained her the Royal Astronomical Society's gold medal. She was the first woman to receive this award and was not joined by another woman until Jocelyn Bell Burnell's recognition in 1989.

Despite her continued successes, her writings at this time became notably bitter and maudlin about the missed opportunities of her life. Publicly, Caroline seemed embarrassed by the many public honours she received, saying that she "did nothing for [her] Brother than what a well-trained puppy Dog would have done."[2]

She remained, however, proud of her achievements, and prepared the following as part of the epitaph for her gravestone: "The gaze of the deceased here below, was turned to the starry heavens; her own discovery of comets and her share in the immortal labours of her brother, William Herschel will testify hereof to future generations."[3] These words would ultimately adorn her final resting place in 1848, after her death at the age of 98.

References

1. M. Hoskin, Caroline Herschel's Life of "Mortifications and disappointments", JHA, 45(4), 2014, p442-466.
2. C. Brock, The Comet Sweeper, Icon Books, 2007.
3. M Bruck, Women in Early British and Irish Astronomy, Springer, 2009

Timeline of Caroline Herschel's life

1740	1740	**William born in Hanover**
1750	1750	**Caroline born in Hanover**
:	1757	**Hanover invaded by French – William flees**
1770	1772	Caroline leaves Hanover for Bath
	1775	American war of independence begins
	1776	William loses Octagon Chapel position
	1778	**Caroline sings Messiah as a soloist**
1780	1781	William discovers Uranus
	1782	**Caroline sings in her final public concert**
	1786	**Caroline finds her first comet**
	1788	**Caroline becomes first paid female scientist**
	1789	French Revolution
1790	1790	Caroline finds her third comet
	1793	England goes to war with France
	1797	**Caroline finds her eighth and last comet** and moves away from William
:	1797	Caroline's British catalogue of stars published
1820	1822	William dies and **Caroline returns to Hanover**
	1825	**Caroline compiles catalogue of nebulae** and receives gold medal
	1848	**Caroline dies in Hanover**

Applying for IST Fellowship

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.

The Fellowship Committee will take into consideration, in support of your application, your qualifications, professional work experience, length of service, supervisory ability and any contribution to the advancement of science, technology, education and training.

Fellows are expected to contribute in some way to the activities and/or development of the IST and the nature and extent of that potential contribution will also be taken into account when Fellowship applications are considered. Contributions could include the submission of journal articles, support for professional registration, enhancement of the IST profile in the workplace – to name just a few examples. We would be happy to discuss options with potential applicants.

Fellows may be nominated (by two or more Executive members) and/or applications made on the designated form, which is available for download. Nominated candidates would be subject to the same review/assessment channels as per individual personal applications.

Application forms and guidance documents can be downloaded at **(istonline.org.uk/membership/fellow).**
T: 0114 276 3197
E: office@istonline.org.uk

Automation in the clinical laboratory: a case study

Raffaele Conte

Abstract

This article will cover the automation in a clinical laboratory, giving a brief introduction on the definitions and history of the mechanisation in the medical laboratory and describing the case study of the instrumental polydiagnostic centre "AMES" (Casalnuovo, Italy).

Introduction

The term automation has been applied in clinical chemistry to describe the process whereby an analytical instrument performs many tests with only a minimal involvement of an analyst.[1] Laboratory testing has grown from a manual "hands-on" process, providing a simple test menu to an instrument-centric high-volume clinical engine inside the modern healthcare enterprise.[1] Automation is necessary in modern laboratories, and automation solutions are beginning to extend their footprints in all areas of the laboratory, such as microbiology, molecular diagnostics, genetics, and toxicology. The term automation applies to both analytical and non-analytical processes (pre-analytical and post-analytical). Briefly, pre-analytical processes are specimen recognition, delivery and processing. Automation permits these steps to be performed sequentially, but with some instruments they may occur in parallel. Post-analytical processes include the transportation to appropriate workstations in the laboratory and the use of software that assists the review of laboratory results. Automation brings to the attention of trained medical technologists any problematic results. Moreover, mechanisation helps in the cataloguing and storage of specimens. Regarding the analytical process, automated analysers are generally designed to perform mechanised versions of previously manual laboratory techniques and procedures. On these aspects, analytical automation provides opportunities for efficiency, reproducibility and throughput that are not possible with manual processes.[2]

Brief history of lab automation

The first automated instrument, the Autoanalyser I, was introduced in 1957 and was able to dramatically increase the instrument throughput (20 samples at a time), compared to manual preparation. Following the Autoanalyser I, other instruments like the SMA (Sequential Multiple Analyser, 1969) and SMAC (Sequential Multiple Analyser with Computer, 1974) reached the market with larger test menus and higher throughputs.[3] The early 1970s saw the development of laboratory information management systems (LIMS) and Laboratory information systems (LIS; more oriented to the clinical environment) able to manage the samples work flow and the electronic interfaces between instruments and software for the releasing of the results. These systems, being able to capture data electronically, helped automate laboratory operation by removing paper-based logs.[4] However, pre- and post-analytic work flows were still highly manual processes at the end of the 1970s. In fact, the pre-analytic phase alone is estimated to have consumed 60% of the time and effort in the total specimen work flow and the contribution of pre-analytic error to total laboratory error ranged from 30% to 86%.[5-6] In the 1980s conveyor belts, circuit boards, and programmable robots were developed in order to solve this problem, and completely automated the laboratory.[7]

Current status

The actual degree of automation is able to handle higher throughputs in order to manage the increased demands of the laboratories. The LIS/LIMS are now capable of governing the entire business process and work flow of the laboratory, working jointly with instruments. Automation solutions are present in two varieties: closed (CA) and open (OA). Of the two, closed automation is the more common. CA solutions are those that are provided by instrument manufacturers and typically connect only to instruments from that vendor. OA solutions exist independently from the instruments in the laboratory and are built by independent companies in order to interface the instruments and the LIS/LIMS, automating all the analytical and non-analytical work flows. The main difference between the open and closed approaches is given by the types of instruments connected to the automation line. Closed lines are provided with instruments and often are integrated in the apparatus, while the open automation solutions are designed and acquired by labs independently of the machines in the laboratory and connect different instruments (e.g. by robotic arm) in order to cross service areas of the lab and provide a single automation solution for the entire laboratory.[8]

Case study

The polydiagnostic centre "AMES" (Casalnuovo, Italy) is a highly specialised laboratory of national relevance, accredited with the Italian sanitary systems for laboratory investigation regarding "Clinical chemistry and Toxicology", "Microbiology and Seroimmunology" and "Genetics". To manage the high throughput of samples, such a laboratory is equipped with a LIMS system (Visual CUPT; Medical Systems SpA) and of many closed automation solutions. Below are three examples of CA used in the laboratories of clinical chemistry, toxicology, and genetics.

Automation in Clinical chemistry

Automated systems in clinical chemistry are differentiated according to the volume of testing that is performed and the capability of connectivity into instrument clusters. Laboratories with low volume of analysis can choose smaller analysers to minimize costs and complexity of maintenance. Smaller instruments can be also used in larger laboratories for specialised methods where test order volume or assay compatibility is not supported or not cost-effective on higher volume instruments. For example AMES polydiagnostic centre possess, among other machines, an automated bench-top protein analyser (Optilite, The binding site group), used only for specialised analysis, and a high throughput automated clinical chemistry system, the ARCHITECT ci8200 (Abbott diagnostic) that combines a clinical chemistry module with an immunoassay module in one connected platform (figure 1). Obviously, such a system is linked with the LIMS system in order to automate the analytic and non-analytic work flow.

Figure 1. ARCHITECT ci8200 system in use at AMES polydiagnostic centre

The ARCHITECT ci8200 combines antibody-based detection methods, immunoassays incorporating enzymes, labels, fluorophores and chemiluminescent detection methods. The great advantage of using ARCHITECT ci8200 is that by varying reagents the same instrumentation can be used for the detection and quantification of many different analytes (e.g. thyroid hormones, immunoglobulins, myoglobin, ferritin and other proteins). The influence of the analysts is eliminated and reproducibility is therefore greatly increased.

Automation in Toxicology

The most recent instrument available in the toxicology laboratory of AMES polydiagnostic centre is the high performance liquid chromatograph coupled to a triple quadruple mass detector (LC-MS/MS), the LCMS-8060 of Shimadzu. Such instrument is also linked to a fully Automated Sample Preparation Module for LCMS, the CLAM 2000 (Shimadzu; Figure 2) to create a closed automation system with many applications. This module, in fact, is able to automatically perform all processes from the direct collection of samples in the blood tubes to sample pre-treatment and analysis. Consequently, this system minimises human error and variability in sample pre-treatment procedures helping to achieve a high-precision, safer, faster, and simpler sample workflow. Also the closed system CLAM 2000- LCMS-8060 is connected to visual CUPT to easily create sample batches with a barcode reader and manage the results. The software released by Shimadzu (LabSolutions) is also able to track solvent levels, calibration curves, QC samples and other instrument parameters to ensure a routine analysis workflow with high-quality results. Examples of analyses automated on this closed system are 25-OH D3 vitamin, Homocystein, steroid hormones (e.g. testosterone, progesterone, hydroxyprogesterone, androstenedione, dehydroepiandrosterone, dihydrotestosterone, cortisol), antiepileptic drugs (e.g. carbamazepine, valproic acid, phenobarbital, oxacarbamazepine, phenytoin), immunosuppressants (e.g. cyclosporine), antitumor drugs (e.g. cisplatin, carboplatin, cyclophosphamide), dihydropyridines and many others xenobiotic.

Figure 2. CLAM 2000 and LCMS-8060 in use at AMES polydiagnostic centre

Automation in Genetics

The genetics facility of AMES polydiagnostic center possesses two next generation sequencing (NGS; Illumina) and one NovaSeq 6000 sequencing system (Illumina). NGS has accelerated the sequencing of genomes through the development of data-analysis approaches to support the increasing size of the sequence dataset, the simplicity of library preparation, the ability to make libraries from tiny input amounts of DNA and the elimination of a bacterial cloning intermediate, keeping a major role in the biomedical research. Such instruments are connected in a closed system with a Hamilton MicroLab Star, to automate DNA sequencing. Such automation allows the simultaneously process of 96 samples in less than 4 hrs, obtaining sample recovery yields higher by 50% compared to the manual method, and providing sample preparation with an average 80% reads on target.

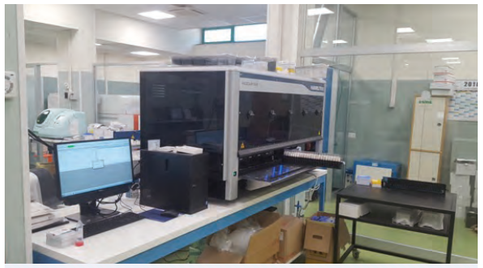


Figure 3. Hamilton MicroLab Star robot in use at AMES polydiagnostic centre

Conclusion

The described examples of mechanisation highlight the importance of automation in increasing precision and reproducibility of data, decrease of the analysis time, and avoidance of errors in non-analytical processes. Currently, every component of clinical laboratory workflow is at some stage of automation. The fields of clinical chemistry and haemotology were the first to be fully automated and toxicology, molecular diagnostics, and genetics will soon follow. With the convergence of the disciplines of laboratory medicine that is driving the movement of specimens across departments, laboratory automation promises to expand and connect all parts of the laboratory in a fully open automation system.

Author

Raffaele Conte, MIScT, RSci is the responsible chemist of the toxicology and clinical chemistry laboratory of "AMES polydiagnostic centre" in Casalnuovo, Italy and a research associate of the "Institute of agro-environmental and forest biology" of the Italian National Research Council (CNR) in Naples, Italy. Apart from his working activity aimed on the detection of drugs and metabolites in biological matrices, his research interests are focused on the design of novel delivery platforms able to minimise degradation, prevent undesirable side effects, and increase bioavailability of drugs or genetic materials. He also follows different projects as an independent researcher and has authored several research papers. In 2015 he started to study for a Ph.D. degree at University of Naples "Federico II" with a project on the synthesis of polymeric fillers with anti-biofilm activity for dental composites. His email address is **raffaele.conte86@tiscali.it**

References

1. Hawker, Charles & R. Genzen, Jonathan & T. Wittwer, Carl. (2017). Automation in the Clinical Laboratory. 370.e1-e24.
2. Streitberg GS, Bwititi PT, Angel L, Sikaris KA. Automation and expert systems in a core clinical chemistry. *JALA*. 2009:14(2):94-105.
3. J.D.N. Nolen. The power of laboratory automation. Medical *Laboratory Observer*. January 2014
4. Gerst A. Gibbon,A brief history of LIMS,*Laboratory Automation & Information Management*.1996;32(1):1-5
5. Guder W. Preanalytical factors and their influence on analytical quality specifications. *Scand J Clin Lab In*. 1999;59(7):545-549.
6. Plebani, M. "Errors in clinical laboratories or errors in laboratory medicine?" *Clin Chem Lab Med*. 2006;44(6):750-759.
7. "Masahide Sasaki, MD, PhD. August 27, 1933-September 23, 2005." *Clin Chem* April 2006; 52(4):791-792.
8. Armbruster, D. A., Overcash, D. R., & Reyes, J. (2014). Clinical Chemistry Laboratory Automation in the 21st Century - Amat Victoria curam (Victory loves careful preparation). *The Clinical Biochemist Reviews*, 35(3), 143–153.

The IST One-day Technical Conference 2019

Conference 2019

Date:
Wednesday 18th September 2019
Venue:
The Birmingham Conferences and Events Centre
Hill Street,
Birmingham,
B5 4EW
One minute walk from Birmingham New Street railway station
istonline.org.uk/news-events/

This exciting one-day conference, its 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.

"The keynote sessions were both v interesting and inspiring! Sometimes it's good to be reminded why science is important and interesting!"

"It was good to hear other people's ideas and I went away with personal actions"

"It's fabulous to learn about an area you wouldn't normally be familiar with and also the struggles that are encountered"
Feedback from our 2018 conference

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.

2 Keynote speakers

Plus 15 talks/workshops, organised in three parallel sessions throughout the day, where you can choose from 5 exciting topics in each session.

See our web page istonline.org.uk/news-events/ for further details

The adventures of Casimir Watkins – naturalist and commercial photographer

Alan Gall, IST Archivist

Introduction

Prior to 1911, the Inca settlement of Machu Picchu in Peru was an archaeological treasure still to be appreciated by the outside world. The expedition led by Hiram Bingham of Yale University found the site on 24 July 1911 and returned to excavate in 1912 and 1914-15. Since then there has been controversy about the "discovery" (see "Debate Rages in Peru: Was a Lost City Ever Lost").[1]

A view of Machu Picchu in 2005 (Courtesy of Gillian Griffiths)

Towards the end of the first expedition an extra member joined, an English naturalist called Casimir Watkins. With his brother Harry he had been collecting specimens of wildlife in Peru.

We have made the acquaintance of Casimir in a previous article. The son of William Watkins, founder of the firm Watkins and Doncaster,[2] he initially followed in his father's footsteps as a naturalist with a taste for adventure, before taking a job as a tour manager. A conversation with a director of the Cunard Steamship Company Ltd resulted in Casimir securing a contract to supply the services of a ship's photographer.

As Ocean Pictures (Southampton) Ltd, numerous photographs were taken on Cunard ships, capturing images of many famous actors/actresses and other well-known personalities.

The Watkins family

Casimir Watkins owed his exotic-sounding and probably unique name combination to Casimir Widmer, his maternal grandfather. At the time of his birth on 15 December 1888 to Amelia Eliza Antoinette and William Watkins, the family lived in Croydon.

Other births at Croyden were the elder siblings Antoinette Annie and Harry. They all moved to Eastbourne in about 1892 where, four years later, Augustus Lubbock Watkins,[3] was born.

The heart disease that had afflicted William Watkins since his army days in India finally caught up with him. In 1899 he retired from business due to ill health and died the following year. His daughter Antoinette went mad, the doctor reporting delusional behaviour brought on by grief over the loss of her father.

Casimir had been sent to live with his uncle Daniel Jones and aunt Ann in Warrington and attended the Boteler Grammar School at age twelve in 1900. Uncle Dan would prove useful when Casimir needed capital to start a business.

Peru

It is known that Casimir and Harry Watkins were in Peru by 1910 as they collected an adult male bird on 7th July, declared to be a member of a subspecies *Schistocichla leucostigma brunneiceps* (spot-winged antbird). The find occurred at Chaquimayo, a village in south-eastern Peru at an altitude of 3000 feet.[4]

Figure 2. Arequipa 2005. Casimir convalesced in the town after contracting measles (Courtesy of Gillian Griffiths)

How the Watkins brothers were financially supported when they first arrived is not known, although Sven Kullander notes that they sent "fish material" to William Frederick Henry Rosenberg, a natural history dealer who sold it on to the British Museum (Natural History).[5] These specimens were collected around the lowlands drained by the Madre de Dios River. Subsequently, in 1915, they were engaged by The American Museum of Natural History and helped amass a large collection of bird skins. WWI had already started and Casimir joined the British Army before hostilities ended, so Harry must have continued without his brother not long after the Museum appointment.

Watkins [Harry] *remained in the employ of the American Museum until 1926, visiting various parts of the country* [Peru]*, carefully selected for their bearing on the problems of distribution and life zones; and the excellent skins now at hand, sent by him, testify to his energy and skill as a collector.*[6]

Incaspiza watkinsi (the Little Inca Finch) is named after Harry Watkins.[7]

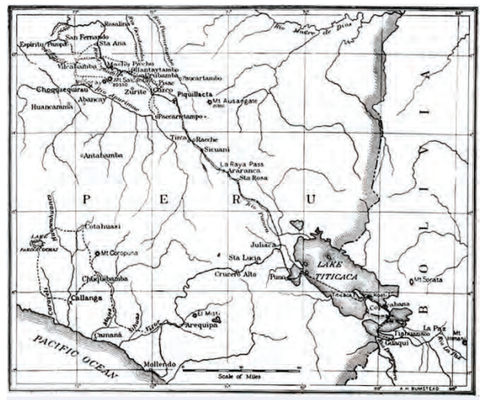


Figure 3. In the north-westerly direction from Arequipa are Mount Coropuna and Lake Parinacochas (Inca Land: Explorations in the Highlands of Peru, 1922)

Hiram Bingham has written about his team's exploits in *Inca Land: Explorations in the Highlands of Peru*. They arrived at the town of Arequipa in June 1911 intending to climb Mount Coropuna. Weather conditions in the Peruvian winter dictated a delay so the party went to explore the Urubamba Valley, where they discovered Machu Picchu. Returning to Arequipa in September, arrangements were made for transport and supplies. Bingham wrote, "Accordingly, I secured in Arequipa the services of Mr. Casimir Watkins, an English naturalist, and of Mr. F. Hinckley, of the Harvard Observatory."[8] The appointments provided someone to take charge of the base camp (Watkins) and someone with climbing experience (Hinckley, who had climbed El Misti at 19,120 ft). In the event, Frank Hinckley's mountaineering prowess did not get tested; he sustained a leg injury after an altercation with one of the mules used for carrying supplies.

Isaiah Bowman	Assistant professor at Yale
Dr William Gage Erving	Physician specialising in orthopaedic surgery
Harry Ward Foote	Assistant professor of chemistry at Yale
Kai Hendriksen	Danish Topographer
Frank Hinckley	Yale undergraduate assistant
Paul Baxter Lanius	Yale undergraduate in the Sheffield Scientific School
Herman Tucker	Experienced mountain climber & assistant to Hendriksen
Casimir Watkins	British naturalist

Composition of the 1911 Yale University expedition under Hiram Bingham.[9]

Figure 4. A photograph taken by Casimir Watkins at the town of Cotahuasi, Peru. To the right are Tucker, Hendriksen, Bowman and Bingham (Inca Land: Explorations in the Highlands of Peru, 1922)

The attraction of scaling the tallest peak in the Coropuna range lay in the fact that its exact height had not been found, and offered the opportunity of conquering what might be even taller than Aconcagua.[10] This turned out not to be the case but a book by a Professor Bandelier gave encouragement with a figure over 23,000 feet (7010 m).[11] The intrepid adventurer and experienced mountain climber, Annie Smith Peck, having read about Bingham's intention to scale Coropuna decided on her own attempt. Apparently, Bingham fearful of being pipped to the post kept an eye on the lady's progress and pushed ahead with his own endeavours.

Figure 5. Base Camp on Coropuna at 17,300 feet (Inca Land: Explorations in the Highlands of Peru, 1922)

Figure 6. Casimir (right) with Hiram Bingham

Bingham and several others set off on 2 October, followed by Casimir Watkins a week later, "who had only recently recovered from a severe illness". The luggage, travelling separately at first, included food boxes, tents, ice axes, snowshoes, barometers, thermometers, fibre cases, steel boxes, duffle bags and a folding boat. Food featured often in Bingham's accounts.

… an abundance of appetizing food adds very greatly to the effectiveness of a party. To be sure, it may mean trouble and expense for one's transportation department, and some of the younger men may feel that their reputations as explorers are likely to be damaged if it is known that strawberry jam, sweet chocolate and pickles are frequently found on their menu![12]

Sugar, in particular, found favour. An allowance of one third of a pound per man per day seemed excessive at first: "After a month in the field the allowance proved to be too small and had to be supplemented."

Worthy of note, in view of Casimir's later occupation, is that Kodak supplied photographic equipment gratis. Hiram Bingham agreed to certain conditions, writing to George Eastman:

We shall do all in our power to develop the pictures as soon as possible after exposure, using your tank developer and furthermore, that we will make reports to you from time to time regarding the nature of the work and the success which we achieve.[13]

Instruments to determine altitude consisted of hypsometers, mercury barometers and aneroid barometers. James J. Hicks, a prominent maker of meteorological and scientific instruments in London, supplied two aneroids, but these devices turned out to be unreliable above a certain height, when the pair of instruments did not give matching readings. One hypsometer was of the scale variety, a sighting device to calculate height trigonometrically,[14] the other an apparatus using the boiling point of water to

Figure 7 James Hicks supplied Watkin aneroid barometers to Bingham's group (Nature, 26 February 1914)

determine height via air pressure. The contents of the pressure hypsometer then provided drinking water.

Aided by the liberal consumption of sugar cubes, four men reached the summit of Coropuna's northern peak on 15 October 1911. They were Bingham himself, Peruvian professor Alejandro Coello (a latecomer to the group), Herman Tucker, and their escort Corporal M. Gamarra. The Danish topographer Hendriksen, who did not join the ascent, later determined the height by triangulation to be 21,703 ft (6115 m), with a mean error of 35 feet. Estimates vary, but 20,922 ft (6377m) seems a typical modern value for what is known as Nevado Coropuna. This makes it the third tallest mountain in Peru, but it is the highest volcanic peak.

Casimir and the others remained at base camp, 17,300 (5273 m) feet above sea level, and greeted the exhausted climbers after their 3 hour descent: "The effect of seeing somebody from the outside world again was rather curious. Tucker admitted afterward that he could not keep the tears from running down his cheeks …"[15] To Bingham's satisfaction it was later found that Miss Peck's party had only scaled one of the lower peaks.

Bingham's team then made preparations to survey Lake Parinacochas: "… we found it impossible to

discover any indication in geographical literature as to whether the depth of the lake might be ten feet or ten thousand feet."[16] In the expectation that it might be comparable to Lake Titicaca (over 900 feet deep in parts) Casimir set about fixing markers at six-foot intervals in a thousand feet of fishing line. Armed with this depth gauge, Bingham and Tucker began taking measurements in November 1911 from an Acme folding boat. Casimir's efforts were in vein, many soundings revealed that nowhere did the depth exceed five feet.

Kai Hendrickson, with Casimir as his assistant, travelled from Cotahuasi to Chuquibamba, crossing the difficult terrain of the Pampa Colorada on a seven-day trek. The Pampa Colorada is an area of desert containing the Nazca lines, geoglyphs (shapes, generally of animals). These could not be seen by anyone on the ground. Not until 1939 were they first observed, when spotted from an aircraft.

High temperatures caused problems taking measurements but they were able to map a number of topological features. Hendriksen made efforts to find the height of Coropuna as accurately as possible by taking sightings from four separate locations.

His calculated values of 21696, 21746, 21714 and 21657 gave an average of 21703 feet.[17]

World War One now intervened. Augustus Lubbock Watkins distinguished himself in action with the Tank Corps of the Monmouth Regiment, receiving the Military Cross.

For dash and coolness when on August 8, in command of a light tank, he advanced eleven miles to Vauvillers, finding many targets of both guns and infantry, showing great initiative.[18]

Casimir served as a lieutenant with the Royal Garrison Artillery. It is not known if he matched his brother with similar daring feats. As already noted, Harry remained in South America during the war.

On 9 October 1920 Casimir married Sybil Isabel Loxley at the parish church of Great Bookham, Surrey. Witnesses to the event were Augustus Lubbock and Antoinette A. Watkins. Antoinette had been treated for mental illness in Bethlem Hospital from the age of fifteen. It is recorded that she spent about a year there over the period 1900-1901 and returned again with recurring symptoms 1902-1903.

For a sale of rare butterflies in 1922, at Stevens' Auction Rooms, Covent Garden, Casimir offered five male specimens of *Morpho zephyritis*.[19] These sold for £5 each and Casimir complained about the meagre return on the investment in time and money. Emphasising the rarity of the female *M. zephyritis*, two of which he had caught, Casimir lamented, "To get these insects I and my brother [Harry] had to live amongst savages in a fever stricken country [South East Peru] in which the only transportation was by canoe."[20] He added, "During the past 20 years my brother and I were the only collectors to send over this great rarity." This suggests the two were active from about 1902. Although this seems unlikely since Casimir was then aged 14, his school record does say that he left in December 1902.

Figure 8. Man with mule, a photo from the Peruvian days, still in possession of the family (Courtesy of Robert Pearl)

Figure 9. Group of unknown persons (Casimir on the far right?), still in possession of the family (Courtesy of Robert Pearl)

Casimir capitalised on his travel experiences by joining the firm of Raymond & Whitcomb. Walter Raymond & Irving Whitcomb were Bostonians who had established an American holiday tour business and expanded by entering the British market, based at 20 Cockspur Street, London. Notes for a talk given by Casimir around 1928 appear to have been aimed at a group of paying customers for the Peruvian experience. The talk centred on the 1911 ascent of Coropuna. In contradiction to Bingham's assertion that Casimir had "only recently recovered from a severe illness", we learn that he had "... nothing more serious than ordinary measles ..."

Elspeth Wills in the introduction to *Stars Aboard* describes how Casimir made a career change while on the Cunard ship Berengaria: "The idea of onboard photography came to young Casimir Watkins over a cocktail with a Cunard director ..." The director in question has been identified as Sir Percy Bates.[21] Casimir then borrowed £500 from an uncle (very likely his uncle, Daniel Jones) to set up the photographic studio on the Lancastria in 1929. Much transatlantic travel followed.

Stars Aboard contains photographs of 50 film stars/performing artists, 5 sports personalities and 20 assorted celebrities, a total of 75 (excluding family members and companions, and counting performing double-acts as one). Most of the images are from the Ocean Pictures collection.

Figure 10. Charlie Chaplin and his fifth wife Oona (Stars Aboard © Cunard Line)

Figure 11. Laurel and Hardy with wives (Stars Aboard © Cunard Line)

Figure 12. Walt Disney and family (Stars Aboard © Cunard Line)

Casimir's transatlantic crossings continued until mid-1950, although a land-based business is on record as occupying premises at Eastbourne in 1946 and 1947.

Casimir died in Southampton on 10 May 1955, a year after he was listed as a photographer on the RMS Caronia's crew complement, bound for New York.[22]

Ocean Pictures (Southampton) Ltd appointed a liquidator in 1970. Cruise Photography Ltd, formed in 1950 by Casimir, his wife and married daughter Pamela Joy Hunter, had engaged a liquidator in 1968.[23]

Ocean Pictures produced many postcards, a selection of which can be found for sale on eBay.

Figure 13. A typical postcard scene from Ocean Pictures (Southampton) Ltd

Author

Alan Gall FIScT, CSci (IST Archivist)

Bibliography of main sources

Bingham, Hiram, *Inca Land: Explorations in the Highlands of Peru* (Cambridge, Massachusetts: The Riverside Press, 1922).

Bingham, Hiram, "The Ascent of Coropuna", *Harper's Monthly Magazine*, March 1912.

Watkins, Casimir, "Coropuna", the text of a talk given c. 1928 (copy courtesy of Robert Pearl).

Wills, Elspeth, *Stars Aboard* (London: The Open Agency, 2003).

Acknowledgements

Charlotte Dunne, University of Liverpool Library.

Ruth Harrington, Senior PR & Social Media Executive, Cunard Line.

Michael Ockenden, Eastbourne Local History Society.

Robert Pearl, great grandson of Casimir Watkins.

David Simpkin, Sussex Photo History website.

References

1. http://www.nytimes.com/2008/12/08/world/americas/08peru.html.
2. "Watkins & Doncaster, the Naturalists", *IST Journal*, Autumn 2015.
3. Possibly named after John Lubbock FRS, first Baron Avebury, a friend of Charles Darwen - rather than a Lubbock ancestor.
4. John T. Zimmer, "Studies of Peruvian Birds. (I) New and Other Birds from Peru, Ecuador, and Brazil", *American Museum Novitates*, 500 (15 October 1931), 19.
5. Sven O. Kullander, *Cichlid Fishes of the Amazon River Drainage of Peru* (Stockholm: Swedish Museum of Natural History, 1986), 19.
6. John T. Zimmer, "Studies of Peruvian Birds. (I) New and Other Birds from Peru, Ecuador, and Brazil", *American Museum Novitates*, 500 (15 October 1931), 2.
7. Frank M. Chapman, "Descriptions of New Birds from Columbia, Ecuador, Peru, and Argentina", *American Museum Novitates*, 160 (26 February 1925), 4.
8. Harvard College Observatory had an outpost at Arequipa called the Boyden Station, named after a benefactor Uriah Boyden.
9. Richard L. Burger & Lucy Salazar (eds), *Machu Picchu: Unveiling the Mystery of the Incas* (New Haven & London: Yale University Press, 2004).
10. Hiram Bingham (1912) reports the height of Aconcagua as 22,763 feet (6940 m). A modern figure is 22,834 feet (6960 m). It is the highest mountain to be found in South America (in Argentina).
11. Adolf Bandelier, *The Islands of Titicaca and Koati* (New York: The Hispanic Society of America, 210). Current values for heights are given in http://www.andes.org.uk/andes-information-files/6000m-peaks.asp
12. Hiram Bingham (1922, 5).
13. Quoted by Amy Elizabeth Cox, "Framing Machu Picchu: Science, Photography and the Making of Heritage", PhD Thesis (University of Florida, 2010), 60.
14. The scale hypsometer enabled the party to determine that the north peak of Coropuna was at least 150 feet higher than the neighbouring peak (Hiram Bingham, 1912, 501).
15. Hiram Bingham (1912, 502).
16. Hiram Bingham (1922, 74-75).
17. Kai Hendriksen in an appendix to Isaiah Bowman, *The Andes of Southern Peru* (Henry Holt & Co, 1916), 318.
18. R.F.G.Maurice (ed), *The Tank Corps Book of Honour* (London:Spottiswoode, Ballantyne & Co, 1919), 149.
19. The Butterflys of genus *Morpho* are noted for their iridescent blue colouration.
20. As reported in the *Dundee Courier* 21 September 1922.
21. Communication from Charlotte Dunne of the University of Liverpool Library (hosting the Cunard Archive).
22. www.caronia2.info.
23. *The London Gazette*, 26 February 1970 and 9 July 1968.

Biology, frequency of fatal attacks in Australia, cannibalistic behaviour, and bite force of the Great White Shark

(Carcharodon carcharias)

Gary Martinic – Western Sydney University

The imposing, frightful image of a 4.5m Great White Shark

Abstract

The Great White Shark (as it is known in Australia; Fig.1), is also known by a number of other names including the "Great White" (GW), the "White Pointer", and more colloquially, as the "White Death", mostly due to the number of human fatalities attributed to it. The formidable size, power and menace of a large adult GW can be obvious from above the water, when viewed by boat crews at the surface. It is the only known shark to lift its head out of the water, scientists believe, to look for prey (seals and sea lions) on rocks, or to scare potential prey into the water. This animal, with its heavy spindle-shaped body and rigid swimming style, has splendidly evolved into the "super-predator" of the oceans. It is the undeniable master of its own environment, for which it is feared, fascinated, and respected by humans.

Zoological Classification and Biology

Zoological classification and animal biology information for the GW and other related species has been primarily sourced from two authoritative texts.[1,2]

Phylum:	Chordata
Class:	Chondrichthyes
Order:	Lamniformes
Family:	Lamnidae
Genus	Carcharadon
Species	Carcharias

Related to its gargantuan prehistoric ancestor Carcharadon megaladon, whose individual teeth exceeded 18cm in length, the GW belongs to the zoological family Lamnidae which are known as the Mackerel Sharks, of which there are 5 distinct species. The Mako shark (Isurus oxyrinchus), a very fast and powerful shark, is a close relative. These large, streamlined and heavy-bodied sharks typically exhibit characteristics such as long conical snouts, large eyes and a large mouth containing a series of bladelike or cuspidate teeth. Their jaws are only slightly protrusible. They are generally darkish-grey on the dorsal region and whitish below in colour. Unlike some other species of sharks such as the Basking shark (Cetorhinus maximus), the large gill openings in the GW do not encircle the head. Perhaps best recognised is their large caudal fin, which often protrudes above the water when they swim near the ocean surface. In the GW this fin is crescent-shaped, almost symmetrical and is shorter than in some other species of large sharks. Typically of this family of sharks, GW has precaudal pits, strong caudal keels, and a long ventral lobe. The GW can reach the size of 6 metres in length, whereas smaller sharks belonging to this family typically reach between 3.0–3.7 m in length. The largest GW ever documented, caught off the coast of Cuba, measured 6.4m (21 ft.). GW weighs between 680-1,800 kg (1,500 – 4,000 lb).

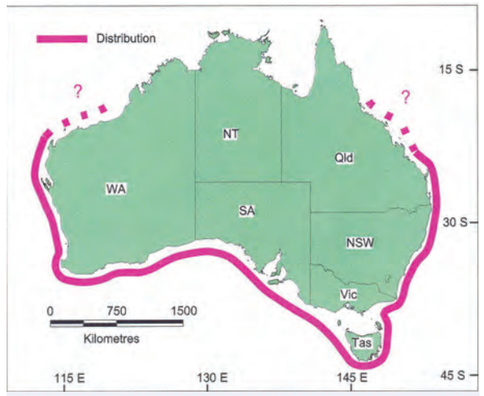


Figure 1. Distribution of Great White Sharks in Australian Waters

The distribution of the GW is that it is found in all cold temperature to tropical seas of the world. Though its typical habitat is in oceanic and coastal waters, from the surface, intertidal, surf line and enclosed bays down to depths of 1280 metres. It is most frequently found off southern Australia, South Africa, northern California and the north-eastern United States. In Australian waters, the white shark's range extends primarily from southern Queensland, around the southern coastline and to the North West Cape in Western Australia.[3] (Figure 2) The diet of this family of sharks includes small to large bony fishes, squid, other sharks, and in the case of the GW, it includes sea turtles, seabirds, sea lions, dolphins, and carrion from dead whales and other mammals. Little is still known about reproduction in these species but they are thought to have litters of between 2 and 10 young each breeding season. The male GW has external claspers located on the far underside of the body, anterior to the caudal fin.[3]

Which Species of Sharks are Dangerous to Humans?

Of the 350 species of sharks belonging to 30 families, and divided into eight major groups that are easily recognisable by certain external characteristics, there are generally only 7 species of sharks which should be considered either highly dangerous, moderately dangerous or potentially dangerous (Fig.3). A danger rating based on the number of recorded fatal attacks on humans and on level of aggression is provided in Table 1 (below):

Common Name	Scientific Name	Danger Rating
Great White Shark	*Carcharadon Carcharias*	★★★
Tiger Shark	*Galeocerdo cuvier*	★★★
Mako Shark	*Isurus oxyrinchus*	★★
Zambezi or Bull Shark	*Carcharhinidae leucas*	★★★
Hammerhead Shark	*Notorynchus cepedianus*	★★
Bronze Whaler Shark	*Carcharhinus brachyurus*	★
Blue Shark	*Prionace glauca*	★

Table 1. List of Dangerous Sharks in Australian Waters.
Key:
★★★ Highly Dangerous.
Highest number of fatal attacks on humans. Attacks without provocation.
★★ Moderately Dangerous.
Second highest number of fatal attacks on humans. Will often attack without provocation.
★ Potentially Dangerous.
Lowest number of attacks on humans, many non-fatal. May attack given the opportunity.

Fatal Attacks on Humans in Australia

According to the internationally-maintained Global Shark Attack File (GSAF),[4] there were a total of 259 fatal and unprovoked attacks in Australia, since records began, giving Australia the morbid honour of being the most dangerous country in the world for shark attacks fatal to humans. Correspondingly, there were 904 unprovoked attacks, of which 645 were non-fatal. Comparatively, the same source provides a figure of 144 fatal and unprovoked attacks, since records began, within the United States (of a total of 1657 unprovoked attacks, of which 1,513 were non-fatal).

Another reference source[5] which collates fatal shark attack figures for Australia does so by state-to-state comparisons, although its results for total fatalities differ from the figures provided by the GSAF data. This source gives the figure for fatal, unprovoked attacks as 283, though this data appears to cease at the close of 2015, whereas the GSAF data is current to Dec 2016 and continues to collate data (unfortunately 2017 annual data was unavailable at the time of this article's publication). Looking at a state-by-state basis, and

since figure began to be recorded, most fatal attacks occurred in New South Wales and Queensland (99 attacks each), followed by WA (33), South Australia (22), Victoria (15) then Tasmania (12). Of these fatal attacks, the majority were attributed to the GW, followed by the Tiger Shark, then to both the Bull Shark, with one recorded case of the Blue Shark fatal attack. These figures therefore confirmthat the first three species listed should be considered potential "man-eaters".

One interesting case of a near fatal Bull Shark attack occurred in the waters of Sydney harbour in 2009.[6] While carrying out routine duties next to one of the Australian Navy vessels, a clearance diver was attacked at the surface of the water by a 3m Bull Shark. Although the 31 year old was badly mauled and lost an arm and had to have his right leg amputated, in an attack which reportedly lasted seconds, he was pulled to safety by three Navy colleagues just in time to allow paramedics to get him to the closest hospital and to save his life. This attack occurred in waters just off the Garden Island Naval Base at the Sydney suburb of Woolloomooloo.

Figure 2. Diagrammatic sketches showing morphology, colouring and comparative sizes of the three species most involved in fatal human attacks (Source: smh.com.au)

Figure 3. An alarming image of a 3.5m GW Shark that has been bitten almost in two by a larger, reportedly 6m long GW Shark (Source: fishingtarget.com)

Cannibalistic Behaviour

The above incident occurred in late 2009, the photograph in Fig.4 shows a 3.5m GW shark which had been bitten almost in half by a larger GW, which itself was reportedly up to 6m in length.[7] This incident occurred not far from a popular swimming beach at Stradbroke Island near Brisbane in Queensland. The smaller GW had been hooked on a baited drum line and was being towed at the back of a Queensland Fisheries Department boat, when it was attacked and completely disfigured, by the much larger GW shark. As can be seen from the image, the huge chunks of eviscerated flesh ripped out of the smaller GW shark's body on both sides display an impressive and powerful biting force (discussed later in this article). It also confirms that there are so-called 'monster' sharks living in the open ocean, up to 6.0m in length.

Camrin Braun, a senior scientist from the Woods Hole Oceanographic Institution, who studies shark behaviour and populations, confirmed that cannibalism in sharks is quite common in both juveniles and adults.[8] Having highly variable diets, GW, and other large predatory sharks are likely 'opportunistic' when it comes to finding food. This is likely to increase in adult sharks when food sources are scarce, and in times of desperation. Cannibalistic behaviour though is often at its peak in GW pups. Stephen Wroe a senior research fellow at the University of New South Wales stated that "intrauterine (pre-birth) cannibalism is often practiced by GW pups, and that it is highly likely any GW that survives into adulthood has already eaten one or more of its siblings."[9]

Therefore it can be determined that GW shark pups are born well developed, but that they must also fend for themselves from day one, or in other words, as pups they learn quickly to "come out fighting" in order to survive. Toni Ferrara, a zoological colleague of Wroe's added that GW "are not born super predators; they take years to become formidable hunters".[9] In fact, GW go through an awkward hunter stage in their "teenage" years, when they cannot hunt large prey very effectively.[9] As they grow into adulthood their experience develops.

While adult GW are capable of eating each other, when there are multiple other food sources available, it is quite rare that they would attack and eat each other. As can be seen from Fig.3 (above), larger adult GW will attack and eat smaller GW opportunistically, for example, when wounded. Aside from the GW, other species of sharks, such as the Sevengill or Broadsnouted shark (Notorynchus cepedianus) regularly feed on other sharks. It is also known that adult GW are carrion feeders and will often feed on whale carcasses when that opportunity arises. It is well documented in the scientific literature that adult GW often feast on elephant seal flesh before moving offshore during their ocean migrations.[10]

Bite Force

Although much has been written about the bite force or relative jaw pressure of the GW and other larger predatory sharks, most articles have been more speculative rather than providing rigid, scientifically-tested data. For example, one earlier source states that an 8 foot-long GW, using computer modelling, can generate a bite force of up to 1.8 tons[11], however, whether this figure is factual is unlikely to be known as it wasn't directly measured. Another source has estimated that the bite force, again using computer-modelling, of a 21-foot (6.5m) GW sharks would produce nearly 4,000psi (or 17,790 newtons),[12] which again, was unconfirmed at the time by rigid scientific testing.

More recently, work has been done which has scientifically compared the strength or bite force in ten top predators in the animal kingdom including the hyena, two species of bears, the gorilla, the jaguar, the hippopotamus, an alligator and two separate species of crocodiles. The only fish to make this list (comprised mostly of mammals and reptiles) was the Bull shark, and not the GW, which didn't even rate a mention in terms of its relative bite force. The animal with the weakest bite force, in this list, was the hyena which was measured at 1,100 pounds per square inch (psi), whereas the animal with the strongest bite force was the Nile crocodile at 5,000psi. The Bull shark came somewhere in the middle of this list measuring 1,350psi, noting that the average strength of a human bite was only around 162psi. In fact, the comparative bite force of the GW came in only at 669.9psi, which is interesting to note.[13] The Bull shark's closest relatives include the Tiger shark and the Lemon shark, all of which belong to the requiem shark family. Just like the GW, the Bull shark is a solid-bodied shark commonly reaching around 3.5m with a large stout head. Listed as a highly dangerous shark (Table 1) it is noted as having an aggressive nature.

It is unclear why, relative to body size, that Bull sharks would have a more powerful bite stronger than the GW, and other larger sharks. One researcher working from the University of South Florida, Maria Habegger, may have answered this question. Habegger and colleagues examined the bite forces produced by 13 species of shark including the GW, Bull shark, Tiger sharks and the Great Hammerhead. They found that Bull sharks had the largest bite force value among these larger predatory sharks, clearly emphasising that sometimes size can be misleading.[14] It is understood that high bite forces are needed by larger predatory sharks, as they usually prey upon large prey items, such as porpoises, turtles and other sharks, thereby noting the mechanical demands of these types of prey.[14] However, Bull sharks do not often feed on porpoises or sea lions, but they do often feed on marine turtles, which require having strong jaws to be able to penetrate turtle shells. This feature would also allow them to eat a more diverse range of prey, in varied environments such as warm, shallow rivers, as well as the open ocean. The researchers stated that a strong bite is particularly useful when hunting in murky water. They explained that in a low visibility environment catching prey may be more difficult than in open water. So once you get a prey between your jaws, securing it is crucial to not lose your meal.[14]

In comparison, the bite force of the GW is approximately half the strength of the Bull shark, perhaps because it doesn't need to be any stronger. Most of the damage inflicted from a GW bite comes from the two rows of its razor-sharp teeth, and not necessarily due to the force of its jaws. Once prey is caught between its jaws, the GW will often thrash from side-to-side to initiate a sawing action which will rapidly disfigure, if not dismember the carcass of its prey. Given the impressive size that these animals usually reach, and with no natural predators of their own (except for the Killer Whale; *Orca orsinus*; which has on a few occasions been known to kill GW)[1] there appears to be no clear reason as to why GW should have the most powerful jaws in the shark family.

Summary

This article has attempted to illustrate that the vast majority of sharks are peaceful and passive living creatures that do no harm to humans, and actually play an important role in the food chain of the world's oceans. However, there are a few species, particularly the GW, Tiger shark and Bull shark, and also a few other species, that are aggressive and will attack humans often without provocation. These species are the masters of their domain and should be respected and given a wide berth. As the Global Shark Attack File can attest, where humans have been unlucky enough to encounter these species in the water, the end result more often than not, has been tragic.

In New South Wales, as early as 1937, the state government had instituted a shark meshing program, which has seen the netting of most beaches for the protection of swimmers and surfers against shark attack.[15] This beach-protection program extending over a 200km area, has been successful in reducing the risk of attack by the larger and more dangerous sharks, as described, and continues today. While Queensland and South Africa use a combination of netting and baited drum lines to target dangerous sharks, NSW relies solely on the use of large mesh (>50cm) set nets.[15] The other advantage of these programs is that they represent an extended sampling period of coastal water in the regions they operate, and provide a reliable record of long-term trends in abundance and distribution of regional shark species, for example, the Grey Nurse shark (Carcharias Taurus), and other marine creatures.[15]

It should be remembered that all sharks play a role in oceanic ecosystems, and without them some

animal populations would increase disproportionately, adversely affecting the marine food chain. When one considers the millions of various shark species that are culled by commercial fishing to provide the likes of "shark fin soup" the issue of the very small number of fatal humans attacks, statistically compared to population size, almost pales into insignificance. The Australian government should be commended for having the foresight to declare two important shark species, the GW and the Grey Nurse sharks as protected species. This protection has been in place since 1999 and continues to this day, and is an example of what can be achieved when sensible conservation policies are implemented and enforced, with species, humans and sharks, ultimately both benefitting.

Author

Gary Martinic, MSc(Hons), DipAppSci, DipAnTech, FIAT, FIScT, is currently Technical Team Leader of Research Laboratories & Animal Facilities at the Western Sydney University. He has spent his entire professional career of more than 30 years working in the biomedical research field. He has held a number of senior management appointments at leading research institutes in Australia including as Technical Supervisor at the University of Sydney, Operations Manager at the Heart Research Institute, Manager of the BioServices Facility at the Westmead Institute of Medical Research, and two stints as Laboratory Manager for both the Centre for Transplant & Renal Research, and the Centre for Infectious Diseases & Microbiology/Marie Bashir Institute for BioSecurity, at the Westmead Hospital in Sydney. Gary has been writing and publishing scientific and technical articles in both national and international journals since the year 1990, having won a number of Author's Awards.

Acknowledgements

The author would like to thank Dr. Shane Griffin and Dr. Edward Narayan for proof reading the manuscript and providing constructive suggestions.

References

1. Pyrzakowski, T. (1987). *Sharks*. J.D. Stevens, Editor. pp. 16-18 and pp. 28. Golden Press Publishers. Reed Business iInformation, Inc. National Library of Australia. (*This text offers a comprehensive global survey, offering a clear and balanced understanding of the shark's evolution, habits and habitats, biology and behavior, and place in the ecological chain*).
2. Last, P.R. and J.D. Stevens. (2009). *Sharks and Rays of Australia, 2nd edn*. Commonwealth and Scientific Industrial Research Organisation. Harvard University Press. (*One of the best revisions of the Class Chondrichthyes since the time of Linneaus. Reviews the major shake-ups in the elasmobranch family tree – including updated family keys. Extensively revised species descriptions reflect additional fisheries and newly gleaned life history and biological information. An essential tool for conservation biologists trying to save threatened sharks, now under siege worldwide*).
3. Malcolm, B.D, B.D. Bruce and J.D. Stevens. (2001). A Review of the biology and status of White Sharks in Australian waters. Department of the Environment, Australian Government, Hobart.
4. Global Shark Attack File. Shark Research Institute, Princeton New Jersey, U.S. See also> http://www.sharkattackdata.com. place
5. Wikipedia. List of Fatal Shark Attacks in Australia. See also https://en.wikipedia.org/wiki/List_of_fatal_shark_attacks_in_Australia
6. ABC News (2009). Navy shark attack victim thanks mates before losing leg. 18 Feb.
7. Belknap, K. (2009). Shark-on-shark attack frightens Australia's Gold Coast. ABC News. Australia. 27 Oct edn.
8. National Geographic (2016). Australia's Cannabalistic Sharks. 19 Feb.
9. Viegas, J. (2014). Shark-eat-shark: are Great White Sharks cannibals? Seeker 06 Nov.
10. Domeier, M. L. and Nasby-Lucas, N. (2008). Migration patterns of white sharks *Chacharodon carcharias* tagged at Guadalupe Island, Mexico, and identification of an eastern Pacific shared offshore foraging area. *Marine Ecology Progress Series* 370: 221-237.
11. Wroe, S. (2008). Great White Sharks: awesome 1.8 –ton bites. *UPI*. 06 Aug.
12. National Geographic. (2012). Bite forces of various predators. 15 Mar.
13. Science Focus (2015). Top 10: Which animals have the strongest bite? 16 Nov.
14. Habegger, M.L. et al. (2012). Feeding biomechanics and theoretical calculations of bite force in bull sharks (Carcharhinus leucas) during ontogeny. *Zoology*. 115 (6): 354-64. Dec.
15. Reid, D.D. et al. (2011). Decadal trends in shark catches and effort from the New South Wales, Australia, Shark Meshing Program 1950-2010. *Marine and Freshwater Research*. 62: 676-693.

Sources of Images Used

Figure 1. Distribution of Great White Sharks in Australian Waters, pp. 70. *In:* A Review of the biology and status of White Sharks in Australian waters. Malcolm, B.D, B.D. Bruce and J.D. Stevens. (2001). Department of the Environment, Australian Government, Hobart.

Figure 2. Three Most Dangerous Sharks. Digital Image. smh.com.au 27 May 2017. Web. 29 Jan 2018. See also: nttp://www.smh.com.au/interactive/2017/sharks/high-hazard/

Figure 3. Monster shark bites great white in half. Digital Image. fishingtarget.com. 27 Oct 2009. Web. 27 Jan 2018. See also: http://fishingtarget.com/en/monster-shark-bites-great-white-in-half.html

Nonverbal communication skills and tips

How to create more impactful content using the power of body language

Linda Yim

There is science behind the way you communicate using your nonverbals and more importantly how you can learn fundamental body language skills to increase your engagement with an audience when delivering technical information. Think of how much time you spend preparing the technical content for a presentation. And then think of how much time you spend in preparing how you will physically present it - which is greater? For most consultants, engineers, scientists and technical contributors the quality in the content is often considered most important for two simple common reasons.

Firstly, you want to convey your message with authority making you seem like the expert in your field. Second, you want to be able to influence others as a leader using your expertise. That's why you practice 'what' you are going to say before you take to the stage or speak at the front of a group. What most people do not realise is that our brain listens and reacts more powerfully through our nonverbals than the words you use (verbal content).

Nonverbal behaviour

Body language is about being perceived as the expert without words and creating impact that will influence your audience almost instantaneously at a subconscious level.

Science research in human behaviour shows that you have natural abilities to convey confidence, likeability and credibility by using your posture, gestures and facial expressions. You can subconsciously become more attractive to the listeners with simple body language skills that can be learned. These 'soft skills' have probably never been taught to you in school. There is increasing evidence that people with higher levels of emotional intelligence encourage better leadership because as your ability to competently manage your own emotions increases, you're also able to deal with conflicts and work better with others in the workplace. Understanding body language means you can better relate to people if you are able to see their real emotions and reactions to your offer, presentation or idea, which in turn leads to better solutions and developing more sustainable client relationships.

Prepare – Practice – Present

Most of us have been taught to converse an idea or pitch using technical skills. A simple breakdown may look like this.

- Prepare content, generally based on your intellect, research and knowledge of the subject.
- Practice memorising and scripted speeches
- Presentation of facts and figures

If you start with "how" instead of "what" you're going to say, the process may look like this;

- Prepare – learn to adopt the nonverbal cues that will increase your presence, making you appear more confident and competent to others.
- Practice – ask someone to watch you present or record yourself speaking to highlight any negative nonverbal behaviour that may come through when feeling nervous or practice being more purposeful with your body language cues until it feels easy to do.
- Present with more ease knowing you are in control of your own nonverbal behaviour often giving you the freedom to engage more openly and authentically with your audience.

Studies have shown that our communication can range from 60% to 93% nonverbal. If only 7% of what you say to an audience is being heard then you need to leverage your body language to capture people's attention, gain support and attract investors. Your ability to communicate effectively with your body language is down to specific areas in the brain being activated. Just like muscles the more you work out, the more you develop strength and control over your body which is no different when it comes to learning activity

in your brain that helps you understand your own nonverbals, as well being able to notice it in others.

This article provides scientifically based advice on how to connect and engage with your audience more easily through the power of body language. This is applicable in any professional setting where you are communicating a type of documentation or providing training to your colleagues.

Impress in seconds

To be recognised as the expert in your organisation or field you must set yourself up with this intent in mind and remember that first impressions happen from the moment someone meets you. Studies have shown how people will form an opinion of you within seven seconds. Most people will subconsciously decide when you walk on stage or enter a room a couple of things such as the following;

- *Do I like you? (People who are likeable create better long-term contacts).*
- *Are you confident in the product or service you are pitching? (This affects your potential investors decision-making process)*
- *Do I feel like I want to connect with you? (The basis of all good relationships starts with connection)*
- *Do I want to be influenced by you? (The way you are perceived can have lasting impacts and affect your level of success in the future).*

Positive body language cues help you leverage the power of body language to make an impactful first impression.[1]

Create your best first impression

Start by making sure your hands are visible and your arms are loose by your sides when walking on stage. Never hide your hands behind objects or have them in your pockets.

In a study by the Science of People they analysed some of the most successful shark-tank pitches aired on US television.[2] The aim of the show is to allow real-life investors known as the 'sharks' to determine if they want to financially back entrepreneurs' ideas on the spot. The study interestingly showed that participants who were most successful to the sharks demonstrated a few commonalities when it came to their nonverbals. They analysed the entrepreneurs walking into the room, looked for smiling, eye contact, level of hand activity and body language cues such as nodding.

Out of the successful pitches a high percentage of the entrepreneurs would show a genuine happiness facial expression, smiled with teeth showing, making direct eye contact across the sharks on entry and some gave a slight nod towards each shark.

In summary this shows by having a combination of positive nonverbal cues, it is possible to create a very powerful imprint within a couple of seconds that will increase your success by being more attractive to investors.

If you are feeling overwhelmed in pitches, you can practice the following simple body language cues to help you engage instantly with your audience and your confidence will build with more practice.

A short study was carried out with data analysts' students at Utah Valley University to see if their perception of cookies could be influenced by body language. The experimenters asked students to rate the taste of cookies from two different tables, and on each table the experimenters appeared to show more positive or negative body language. The study concluded with 11% of the students having no preference. Out of the students that had a preference 61% thought that the cookie from the positive body language table tasted better. The experimenters used the same cookies for each table, so whilst there was no difference to the actual cookies, people perceived them as better. This indicates to us the power of body language and it can be influential.

The POSE strategy

- **Power**.
  Alpha behaviour shows that leaders tend to dominate their space which is perceived almost immediately by the brain as confident and power. Practice planting both feet firmly on the ground whether sitting or standing, roll your shoulders back and keep your chin and forehead facing straight out.
- **Openness**.
  The way you stand can increase your level of trustworthiness, sympathy and honesty in an interaction which is known as fronting. Pay attention to how you orient yourself when speaking to someone important. Practice facing your entire body including your feet to who you are talking too because it's a way to make them feel more important and respected by you, which helps you build a deeper level of connection with that person.
- **Smiling**.
  Smiling indicates happiness and when people genuinely feel you are happy, they tend to feel more positive around you. This will make you more charismatic at any networking event and talking about subjects that may not be immediately interesting for them. Leaders with alpha behaviour tend to smile less to appear more calm and confident in a work environment. It is important to smile to create your best first impression to achieve the results you want.
- **Eye gazing**.
  There are different nuances to eye gazing and typically we can naturally hold mutual gazing for about 60-70% of the time during any conversation. Making eye contact is important as it helps our brain release oxytocin which is the chemical hormone for connection. Whilst you don't want to stare people out and cause awkwardness, if your aim is to build deeper connections with people you must maintain a good level of eye contact with your audience and even in a one on one situation.

How TED speakers engage with the audience

Another study was carried out by the Science of People who analysed TED talks from 2010 looking for patterns.[3] It was found that the most popular TED talks (over 22million views on YouTube) had on average of 465 hand gestures per talk (18minutes). This was almost twice the average number of hand gestures when compared to the least popular talks (less than 40,000 views on YouTube) that has an average of 272 hand gestures. This tells us that your hands are an influential part of your presentation, as well as your words and your visual aids. Gesturing with your hands helps tell your story, sell your product and generate greater interests from your audience because it acts like a second track of communication in the brain.

Speaker tips

Here are a couple more nonverbal tips that will help you stand out from the crowd and pack a punch in your presentation.

1. **Communicate with visible hands.** *Use your hands, palms up, softly and gently to add emphasis when speaking. Avoid jerky, orchestra type of hand movements which is distracting.*

2. **Speak with authority.** *There are ways in which you can sound more authoritative through voice intonation and cadence. A confident leader will speak with lower voice tones and at a slower pace.*

3. **Be authentic.** *You are authentic when your body language, words and emotions are congruent. The best presentations and most memorable people you meet are the ones who have absolute conviction in what they are saying and our body language is consistent with how we really feel.*

4. **Identify nervous behaviour.** *When feeling nervous or anxious the body will naturally show these emotions which can be perceived by others. Whilst we cannot eliminate nervous behaviour it is possible to be aware of your negative gestures. Pay attention to any self-soothing gestures such as rubbing your hands together, pacing, jerky movements and clutching objects against your body because these are all subconsciously sending out signals that you are not comfortable in your immediate environment.*

Conclusion

Learning the soft skills of body language provides a solid foundation in communicating more easily and effectively in any relationship, and personally or professionally. Raising awareness is the first step, and adopting more powerful nonverbal behaviour is the second step leading to more fulfilling and valuable interactions.

Two people can have the same presentation or describe a service, programme or product using an identical sales script. The difference will always be how you interact with the person in front of you that will make them listen, feel connected to you and want to learn more from you. Studies have shown that your brain is able to decode nonverbal signals twelve to thirteen times more powerfully than accompanying words.

Always use your nonverbals positively whether you are teaching or simply sharing an idea. When you are in control of your body language you create a stellar presence by using 100% of your communication skills. Encouragement and inspiration comes from both your words and your actions.

Author

Linda Yim is a certified body language trainer with the Science of People and METT qualified with the Paul Ekman Group, who specialise in human deception detection. She has 13 years of experience in being an engineering consultant and is currently the senior compliance engineer at Hoare Lea.

E: lindayim.uk@gmail.com
W: www.lindayim.com

References

1. www.psychologicalscience.org/observer/studying-first-impressions-what-to-consider
2. www.scienceofpeople.com/2014/01/pitch-idea-shark-tank
3. www.scienceofpeople.com/2014/01/pitch-idea-shark-tank

Clarence Dally: a technician in trouble

Andy Connelly

Short biography: Clarence Dally (1865-1904) was a glass blower and assistant to Edison in his work on X-rays. His was one of the first deaths attributed to the effects of X-rays.

X-rays may be invisible to the human eye, but they have allowed us to see beyond the capabilities of the human eye. They have shown us the atomic structure of materials, the inside of the human body, and they have enabled us to see deep into the universe. X-rays were discovered several times from 1785 onwards until Wilhelm Roentgen made a thorough study of their properties, winning the Nobel prize in 1901. He also took the first X-ray image of a person – the now famous image of his wife's hand (Figure 1) – but he never patented his discovery and died in poverty.

When Thomas Edison heard of these mysterious rays, he set about a series of experiments with his highly skilled glass blower assistant Clarence Dally, looking at methods of harnessing X-rays to produce a new kind of electric light. The unfortunate result of these experiments was that Dally became the first death recorded as caused by X-ray exposure at the age of just 39.

Dally was born in 1865, the final year of the American Civil War, in Woodbridge, New Jersey, and grew up in a country struggling to heal from the wounds of that war. His father Charles worked as a glass blower at the Edison Lamp Works in nearby Harrison. It may have been stories of the Civil War which led to his enthusiastic enlistment in the Navy as a chief gunner's mate aged 17. In an interview many years later Dr W.B. Graves, who would become one of Clarence's surgeons, described Dally as, "a wiry chap, as hard as nails; a little fellow, but a specimen of perfect manhood when he left the United States Navy."[1] Dally served six years before he was honourably discharged.

Returning home to Woodbridge in 1888, Dally started working with his father and three brothers at the Edison Lamp Works. The 1880s was a great time to be a glass blower as Edison had only recently developed a commercial lightbulb and the early designs required many skilled glass blowers in their production. Dally trained under his father and showed great skill and dexterity in the delicate art of glass manipulation and in the difficult process of "sealing-off" incandescent lightbulbs. Edison, a regular visitor to the factory floor, recognised Dally's skills and transferred the now 24-year-old Dally to the West Orange laboratory to assist in Edison's experiments on incandescent lamps.

Figure 1: First medical X-ray by Wilhelm Röntgen of his wife Anna Bertha Ludwig's hand showing her wedding ring.

It was only a few years later, in the last few days of 1895, that Wilhelm Conrad Roentgen delivered his preliminary report entitled "On A New Kind of Rays" to the Wurzberg Physical Medical Society[2]. In a matter of weeks the news spread across the world and "Roentgen mania" enveloped scientists, inventors, journalists, and the general public, all of whom speculated on the potential impact of this revolutionary discovery. Concerns about the dangers of X-rays were also quickly raised but such was this mania that many workers ignored the warnings, convincing themselves that the tissue damage reported by various researchers was caused by other effects.[3]

Roentgen had used both photographic plates and fluoroscopes to explore the properties of X-rays. His fluoroscopes used a layer of barium platinocyanide crystals coating the inside of a glass screen. These crystals would fluoresce (glow) when X-rays hit them and so show a shadow image of whatever was put between the X-ray source and screen. However, these early fluoroscopes produced only faint light and so faint X-ray images. After trying around 1300 compounds, Edison and his team discovered that calcium tungstate fluoresced 12,000 times more brightly than the barium platinocyanide that Roentgen had used. This led Edison to believe that he had found his fluorescent lamp (see Figure 2).

The difficulty of producing glass X-ray tubes, fluorescent lamps, and fluoroscopes meant that skilled glass blowers were crucial in the development of Edison's ideas. Clarence Dally, and his brother Charles who later joined him, were put to work and Dally soon became fascinated. He took to the work enthusiastically using his glassblowing skills to produce thousands of different X-ray tube prototypes. Dally had to test each tube and fluoroscope many times by holding his hand between the X-ray source and a fluorescent screen, exposing him to huge doses of X-rays.

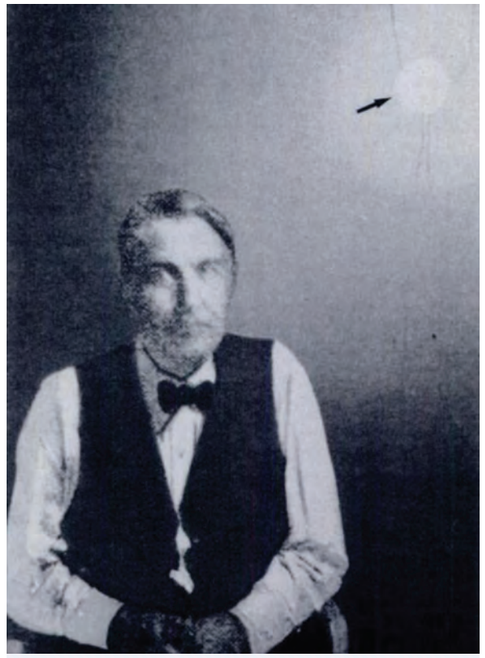


Figure 2: Thomas Edison photographed with his X-ray tube fluorescent lamp (arrow).[4]

Dally and his brother were essential to Edison's work, particularly when the X-ray facilities were transported and manipulated during demonstrations. The first public demonstration of Edison's new fluoroscope was at the National Electric Light Association held in New York City in May1896. It was a sensation. It is difficult now to imagine the effect on the public of seeing their own bones for the very first time. Dally's job was to keep the temperamental system running and this meant close and continued contact with the equipment, resulting in a level of exposure that caused Dally's hair and moustache to fall out. It had not yet been noted that the damage caused by X-rays was cumulative and it was still assumed that the effects could be reversed with time away from the source.

Edison saw this research as a contribution to science and refused to patent the new screen, instead arranging for them to be manufactured and sold at modest prices for medical use[5]. However, as X-ray technology became more widely used, doctors found they preferred the more permanent photographic plate record for X-rays rather than the Edison's fluoroscope. Photographic plates also meant a much lower dose of X-rays to the radiographer and patient.

Figure 3: Dally (arrow) undergoes fluoroscopy by Thomas Edison.[4]

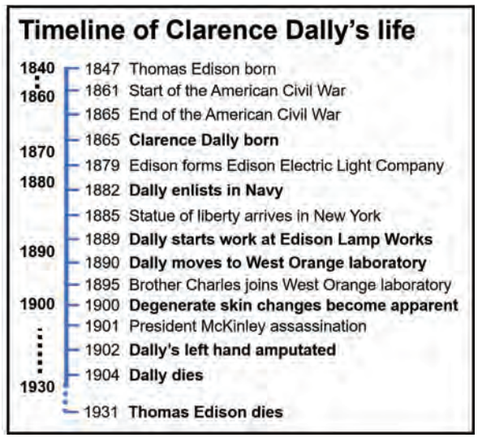
By 1900, Dally was suffering radiation damage to his hands and face. When his left hand became reddened, swollen, and extremely painful from testing the X-ray tubes, he just started to use his right. Eventually he was forced to periodically take time off work, only to return after the pain and swelling had subsided. Around this time Edison himself developed problems with his own eyesight and that convinced Edison that prolonged exposure to X-rays was dangerous. He stopped working with X-rays himself and also encouraged Dally to stop, but he would not. About his plans for using X-rays to produce a fluorescent lighting system Edison later admitted to the *New York World*, "I could make the lamp all right, but when I did so I found that it would kill everybody who would use it continuously."[1]

Figure 4: Clarence M. Dally[6]

Edison continued to pay Dally even when he could not work and paid for the best dermatologists and surgeons on the East Coast to attend to him. In 1902, one lesion on Dally's left wrist was treated unsuccessfully with 144 skin grafts from his legs but the tissue was so badly damaged that the hand had to be amputated. An ulceration on his right hand necessitated the amputation of four fingers. Eventually, cancer caused by X-ray exposure had spread to such an extent that it became necessary to amputate both arms simultaneously. Even this major surgery was not sufficient to preserve Dally's life and he died in October 1904.

Dally was survived by a wife and two children. Dr W.B. Graves said of Dally, "He presents to science a pitiable object-lesson of the dangers of inexperienced or continuous experiments with X-rays, and his

sufferings have done more to bring to professional notice a correct knowledge of things to be avoided than anything else in the history of scientific research upon this subject."[1] However, to remember Dally solely as a tragic figure is to forget the contribution he made to the improvement of the X-ray tube and fluoroscope, which had a huge impact on the medical profession and saved many people's lives.



Author

Andy Connelly 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.

References

1. Edison Fears Hidden Perils of the X-rays, *New York World*, August 3, 1903, accessed from https://web.archive.org/web/20110816170318/http://home.gwi.net/~dnb/read/edison/edison_xrays.htm
2. O. Glasser, William Conrad Roentgen and the early history of the roentgen rays. Springfield, IL: Thomas, 1934
3. R.A. Gagliardi, Clarence Dally: An American Pioneer, *American Journal of Roentgenology*, 157:922, November 1991 p992
4. D. J. DeSantis, Early American Radiology: The Pioneer Years, *American Journal of Roentgenology,* 147:850-853, October 1986. p.850-853.
5. P. Israel, Edison: A life of invention, John Wiley & Sons, Inc., 1998.
6. P. Brown, Clarence Madison Dally (1865-1904), American Martyrs to Radiology *American Journal of Roentgenology*, 1995;164, p237-239

Footnote

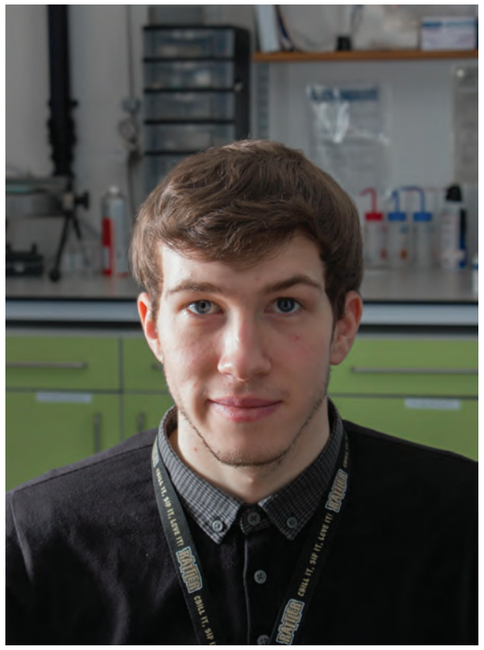
Clarence was not the only technician to suffer in the development of X-ray technology. Roentgen's own technicians suffered major medical issues with their hands. This is shown in Figure 5. I have not been able to find out the name of this technician pictured – or the source of this image.

These are the hands of the engineer who made many of Professor W. C. Roentgen's early X-ray tubes. They illustrate the damage that occurs as a result of excessive irradiation. Note the relatively undamaged thumbs which have by chance been shielded by the film cassettes and screens which he held in the X-ray beam.

#Technician Journey

Christopher Turley is a laboratory technician at the Nanoscale and Microscale Research Centre at the University of Nottingham.

Ana Parodi asks Christopher what he does at the University of Nottingham.



Christopher is a laboratory technician at the Nanoscale and Microscale Research Centre. At only 19 years old he is fully immersed in the practical world of science, carrying out many tasks such as sampling, testing, measuring, recording and analysing results.

He explained about the different machines they use in the research centre. The Raman Spectroscopy is the one responsible for identifying chemicals, forensic materials, microparticles, organic and inorganic material as well as mapping in 2D and 3D. The TEM (Transmission Electron Microscopy) can image micro and nano scale, tissue and cellular structure with a resolution of Angstrom scale as well as crystallographic and chemical imaging. The last one is the SEM (Scanning Electron Microscopy), this one can give a high magnification and depth of field with a 3D perspective as well as surface identification; it is applied to micro and nano particles.

Christopher decided to start working as a technician because he had a great passion for science but didn't want to pursue a degree in it. This decision led him to learn all about image analysis and how everything in the lab works, testing, measuring, and helping others to understand the role of the nanoscale and microscope research centre.

Christopher sees the role of a technician as being very important. He has to explain and show others what to do and why, which can be a very difficult given his young age. Some people are not accustomed to having a young person teach them. He obviously does an excellent job describing to others the functions of each machine while carrying on with all his other duties as a laboratory technician.

Apart from his job in the laboratory he also has a personal passion for digital photography.

Getting to know Christopher and the Nanoscale and Microscale Research Centre was a wonderful experience and I'm grateful that he could explain all the work he does as a laboratory technician and I hope that I can come again to the lab and further my own knowledge in the imaging field.

Christopher Turley was interviewed by Ana Parodi, University of Nottingham.

#Technician Journey

Jagdish Heer manages a pharmaceutical laboratory at the University of Nottingham

Ella Fornari asks Jagdish what she does at the University of Nottingham

We've caught up with Jag to learn what it's like running a lab that preps dissections for pharmaceutical tests.

Jagdish Heer has been working in the pharmaceutical testing lab at the University of Nottingham for 7 years now. She mentors in-coming pharmacy students on their first research projects and oversees the day to day functions of the lab.

Her research focus is using organ bath pharmacology procedures to test how living tissues react to various drugs.

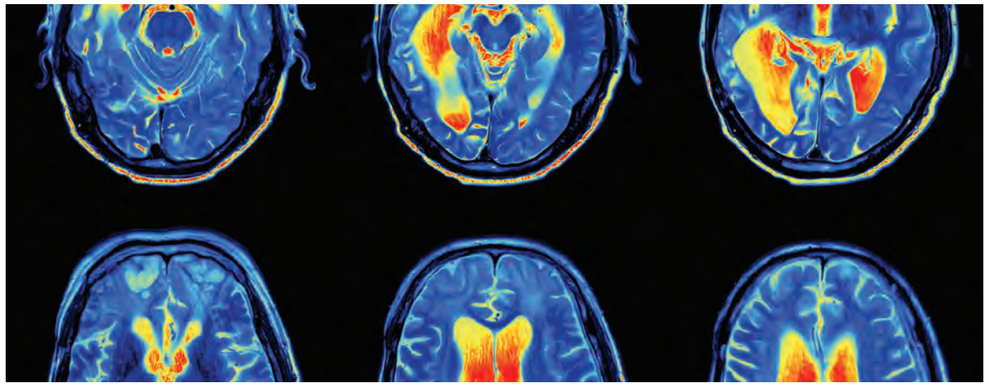
In organ bath pharmacology a tissue, typically from pig in Jag's lab, is run through a system that mimics respiratory activity on the tissue. Researchers can then pump various drugs they are testing through the tissue to get a sense of how a living tissue may react to the drug. Since much of the activities of the lab involve organ bath pharmacology procedures, a huge part of Jag's job is setting up dissections.

This includes pulmonary dissections to test the effect of drugs on heart function.

With eighteen students under her tutelage every year, Jag says that working with students is her favourite part of the job.

Jagdish was interviewed by Ella Fornari, University of Nottingham.

UKB brain imaging and genetics studies are transforming health research



In October of this year two papers were published in Nature which explains how UK Biobank genetics and imaging data are transforming health research.

In one paper, researchers report on a pioneering study that combined 10,000 UK Biobank MR brain images with genetics data from all 500,000 participants.

The team found a genetic link for some of the most fundamental processes that allow us to think, act and function, from the size of the parts of the central nervous system that control sight, hearing, speech, emotions and actions, to the integrity of the communications channels between them and the strength of the signals within. The results will provide a huge impetus to new research for a wide range of degenerative and psychiatric disorders and ultimately improve treatments.

The work is funded primarily by the Medical Research Council and the Wellcome Trust.

"We have had a tantalising glimpse of what could be," said Professor Steve Smith, University of Oxford, who led the study. "These game-changing data stored within the UK Biobank resource, and growing in size and value all the time, will revolutionise our understanding of complex brain disorders."

Revolutionising our understanding of complex brain disorders

With 20,000 more participants already scanned and 70,000 still to go UK Biobank would transform understanding. In particular, the researchers studied 3,144 different measures of brain structure and function, resulting in the discovery of more than 100 areas of the human genome that influence the brain:

- Results revealed the effects of genes coding for a "scaffold for tissue healing" in white matter pathways, affecting diseases such as multiple sclerosis, stroke and motor neuron disease. This scaffold is crucial for the growth of white matter in early life, and for the white matter to heal itself from damage by disease.

- The researchers mapped for the first time the signature of genetic influences on iron deposits in the brain, for genes related to neurodegenerative disorders such as Parkinson's disease and Alzheimer's disease. Researchers hope the work will lead to new insight into how these diseases progress and damage mental capacity, and also help generate new imaging-based ways to evaluate disease treatments in the future.

- Another finding relates to the effect of the ROBO3 gene on the brain's white matter pathways. Mutations in the gene mean that pathways that normally connect one side of the brain to the other do not develop properly. This can result in gaze palsy, a disorder which affects the movement of the eyes. It was found that the UK Biobank brain imaging is able to non-invasively localise the effects of this gene to exactly the pathways affected in this disorder.

- The work also localised effects in the brain of genes that have been linked to both early-life brain development and mental health disorders such as depression and schizophrenia.

One of the largest and most comprehensive studies of population health in the world

There was praise for the work from UKRI Chief Executive Professor Sir Mark Walport, who commented: "UK Biobank is one of the largest and most comprehensive studies of population health in the world. Genetic variation helps to explain important differences between people in health and disease. This largest ever investigation of the genetic basis of brain structure and function will provide unrivalled insights into neurodegenerative and psychological disorders, including Parkinson's and Alzheimer's diseases, depression and schizophrenia.

"The scale of this study is quite extraordinary, looking at over 3,000 different measures of brain structure and function in 10,000 Biobank volunteers who have had MRI brain scans, and finding over 100 areas of the human genome that influence these. None of this could be achieved without the generosity and trust of the half million participants in UK Biobank, and the global leadership of the outstanding team that runs it and makes the data globally available. The data from UK Biobank is fuelling a new era of genetic medicine. The NHS will be amongst the leading beneficiaries."

Whole genome genetic data of all 500,000 participants

Another paper, celebrated the release of whole genome genetic data of 500,000 participants of the UK Biobank, already being used by hundreds of researchers around the world.

The achievement was a culmination of several years' work carried out by a consortium of genetics experts from Oxford and expertise based at UK Biobank's Coordinating Centre in Cheadle.

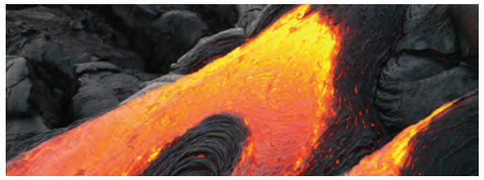
Professor Rory Collins, UK Biobank principal investigator, said it meant that UK Biobank is enabling novel genetic health research worldwide.

"Thanks to the vision of UK Biobank's funders, the altruism of the study participants and the contributions of a large number of scientists who have helped us along the way, UK Biobank is coming of age as a force in health research," Professor Collins said.

The data allow researchers to study a range of important questions such as the underlying genetics of disease, and the interactions between genetic and lifestyle factors, as well as using genetics to learn more about the biology of the diseases themselves, providing insights which can lead to new treatments and preventative measures.

Another important feature of the data is the imputation of different gene arrangements in the HLA region, the region of the genome responsible for many of the functions of our immune system. These variants are known to play a key role in many diseases but are difficult to measure directly, and so are unavailable in many other genetic studies.

Genomics holds the key to unravelling history of life



A new study led by scientists from the universities of Bristol and Bath has used a combination of genomic and fossil data to explain the history of life on Earth, from its origin to the present day.

Palaeontologists have long sought to understand ancient life and the shared evolutionary history of life as a whole, but the fossil record of early life is extremely fragmented. Its quality significantly deteriorates further back in time towards the Archaean period, more than 2.5 billion years ago - the time when the Earth's crust had cooled enough to allow the formation of continents, and the only life forms were microbes.

There are very few fossils from the Archaean period, and they cannot be confidently assigned to the evolutionary lineages with which scientists are familiar. Fossil evidence is so fragmented and difficult to evaluate that new discoveries and reinterpretations of known fossils have led to a rise in conflicting ideas about the timescale of the early history of life.

"The problem with the early fossil record of life is that it is so limited and difficult to interpret", explained Holly Betts, lead author of the study, from the University of Bristol's School of Earth Sciences, "careful reanalysis of the some of the very oldest fossils has shown them to be crystals, not fossils at all."

However, a team of scientist from the universities of Bristol and Bath have adopted an alternative approaching to dating life.

"Fossils do not represent the only line of evidence to understand the past," explained co-author Professor Philip Donoghue. "A second record of life exists, preserved in the genomes of all living creatures."

By combining fossil and genomic information, the team are able to use an approach called the "molecular clock". This approach is loosely based on the idea that the number of differences in the genomes of two living species (say a human and a bacterium), are proportional to the time since they shared a common ancestor.

By making use of this method the team were able to derive a timescale for the history of life on Earth that did not rely on the ever-changing age of the oldest accepted fossil evidence of life.

Co-author Professor Davide Pisani said: "Using this approach we were able to show that the Last Universal Common Ancestor of all cellular life forms ("LUCA") existed very early in Earth's history, almost 4.5 Billion years ago - not long after Earth was impacted by the planet Theia, the event which sterilised Earth and led to the formation of the Moon.

"This is significantly earlier than the currently accepted oldest fossil evidence would suggest. Our results indicate that two "primary" lineages of life emerged from LUCA (the Eubacteria and the Archaebacteria), approximately one billion years after LUCA.
"This result is testament to the power of genomic information, as it makes it possible to discriminate between the oldest eubacterial and archaebacterial fossil remains."

The study confirms modern views that the eukaryotes, the lineage to which human life belongs (together with the plants and the fungi, for example), is not a primary lineage of life.

Professor Pisani added: "It is rather humbling to think we belong to a lineage that is billions of years younger than life itself."

This research was funded by the Biotechnology and Biological Sciences Research Council and the Natural Environment Research Council.

Research paper: Nature Ecology & Evolution: Integrated genomic and fossil evidence illuminates life's early evolution and eukaryote origin - Betts H.C, Puttick M.N., Clark J.W., Williams T.A., Donoghue P.C.J., and Pisani D. DOI: 10.1038/s41559-018-0644-x.

Elderly could keep their mobility, thanks to the "right trousers"

Researchers at the University of Bristol are developing "smart trousers" with artificial "muscles" which could help the elderly and disabled with their mobility.

The project, funded by the Engineering and Physical Sciences Research Council (EPSRC), incorporates a number of technologies including smart electronics and graphene. Some items of clothing which make use of these, including a pair of "power trousers", have been demonstrated at the British Science Festival in Hull.

Approximately 10 million people in the UK are believed to experience problems with mobility. A further 1.2 million who have suffered a stroke, requiring assistance with walking, sitting, and standing, and with other day-to-day tasks like dressing. By 2046, nearly a quarter of the population of the UK could be aged 65 and over, with an associated growth in the need for social services to provide occupational therapists and carer staff.

The "power trousers", which bring together experts in fields including functional 3D-printing, smart-material development and artificial muscle technology, are expected to provide a 5-10 per cent increase in strength to the wearer's own muscles, within a decade.

One feature of the trousers is a pneumatic device which inflates bubbles inside the garment, to push the seated wearer into a standing position. The trousers have been likened to the robotic garments featured in the famous animated film starring the characters Wallace and Gromit "The Wrong Trousers".

Jonathan Rossiter, Professor of Robotics at the University of Bristol and the lead researcher on the project, believes that in the future it will be possible to choose a pair of "assistance" trousers from a store, just as with "regular" garments today.

The prototype garments currently resemble Lycra cycling trousers; however, the researchers are confident that the trousers can be developed in more "tasteful" styles, and should also be washable.

R&D investment set to provide step up for Creative Industries

From screen industries and digital storytelling to fashion and videogames, some of the UK's best performing and world renowned creative businesses are to receive a major boost from investments announced today by the Arts and Humanities Research Council (AHRC) [1].

The unprecedented investment offers support to the UK's globally important creative industries, which are already worth over £92 billion to the UK economy and export an estimated £46 billion in goods and services each year [2].The aim is to create jobs and drive the creation of companies, products and experiences that can be marketed around the world, significantly contributing to UK economic growth both regionally and nationally.

The Creative Industries Clusters Programme is part of the Government's Industrial Strategy [3], and comprises nine creative clusters and a new Policy and Evidence Centre. The Programme will bring together world-class research talent with companies and organisations from across the UK's four nations in a first-of-its kind research and development investment.

Professor Andrew Thompson, Executive Chair of the Arts and Humanities Research Council, said: ***"Combining world-class arts and humanities researchers with our globally renowned creative industries will underpin growth in this vibrant and rapidly expanding sector within the UK economy. "These pioneering partnerships between industry and universities are providing a huge vote of confidence for a sector that is vital to the future prosperity of the UK."***

Professor Andrew Thompson, Executive Chair of the Arts and Humanities Research Council, said: "Combining world-class arts and humanities researchers with our globally renowned creative industries will underpin growth in this vibrant and rapidly expanding sector within the UK economy.

"These pioneering partnerships between industry and universities are providing a huge vote of confidence for a sector that is vital to the future prosperity of the UK."

Each of the nine clusters emerged from an open, rigorous and peer-reviewed selection process that began a year ago. They bring together a range of educational and commercial partners to tackle unique R&D challenges identified by a specific area of industry. The clusters span the UK: from Bristol and Bath, Yorkshire and the Humber and South Wales to Edinburgh, Dundee, Belfast and the south east of England [4].

The funded projects will accelerate growth in a range of creative sectors including the broadcast and screen industries, fashion textiles and technology, fashion design innovation, data and design, animation and videogames, digital storytelling and creative audio-visual.

In parallel, this investment also establishes a new Policy and Evidence Centre. The Centre will address the fact that while the national economic strength of the UK's creative industries are unquestioned, gaps in the evidence base still exist. Led by global innovation foundation Nesta [5], with university partners across the UK, the new centre will connect stakeholders within the sector, research communities and policy makers. It will develop independent evidence that will inform decision-making across the creative industries and underpin future policy decisions.

The nine Creative clusters will be showcased at the Beyond Conference, which will mark the start of a new chapter in the UK's creative industries. Exploring the sector's future and potential to grow, innovate and lead as well as learn from its global partners and competitors.

The Beyond conference will take place on Tuesday 13 November 2018 at Milton Court, Barbican in London, with tickets going on sale in mid-September, visit **beyondconference.org** for more information.

References

1. The Arts and Humanities Research Council (AHRC), which is part of UK Research and Innovation, funds world-class, independent researchers in a wide range of subjects: archaeology, area studies, the creative and performing arts, design, digital content, heritage, history, languages, philosophy and much more. This financial year we will spend approximately £98 million on research and postgraduate training in collaboration with a number of partners. The quality and range of research supported by this investment of public funds not only provides economic, social and cultural benefits to the UK, but contributes to the culture and welfare of societies around the globe.
2. All industry statistics sourced from the Creative Industries Federation: www.creativeindustriesfederation.com/statistics
3. The Industrial Strategy sets out a long term plan to boost the productivity and earning power of people throughout the UK. It sets out how the UK Government is building a Britain fit for the future – how it will help businesses create better, higher-paying jobs in every part of the UK with investment in skills, industries and infrastructure.
4. The nine successful clusters focus on the following challenges (see the nine clusters listed below).
5. Nesta is a global innovation foundation. It backs new ideas to tackle the big challenges of our time, through its knowledge, networks, funding and skills. Nesta works in partnership with others, including governments, businesses and charities. It is a UK charity that works all over the world, supported by a financial endowment. To find out more visit www.nesta.org.uk

National survey launched by Centre for Performance Science

HEartS
Health, Economic, and Social impact of the ARTs

The Centre for Performance Science (CPS) has launched the HEartS music survey.

The Health, Economic and Social impact of the ARTs (HEartS) project is a major £1 million study funded by the Arts and Humanities Research Council (AHRC) examining the health, economic and social impact of the arts on public health. The project strives to advance our understanding of how arts and cultural engagement in the UK can support people's lives. You can take part in the music survey at: **www.surveymonkey.com/r/_HEartSMusic**

The new survey was created to explore a surprising gap in understanding: the relationship in the general population between music activities - such as singing in a choir, learning an instrument or attending concerts – and outcomes for mental health and social wellbeing. The ultimate goal is to shape music's role in society and illuminate its value for public health.

Professor Aaron Williamon, HEartS principal investigator and Director of the CPS, said: "We are keen to discover not only the effects of culture on health and happiness, but the reasons for those effects. For example, singing in a choir has been shown to improve mental health, but is this the result of socialising with others or something inherent to the very process of creating music? And how is this different from other social pursuits, such as sharing a meal with friends or going to the cinema?"

The CPS is a cross-institutional partnership between the Royal College of Music and Imperial College London. Its internationally distinctive research focuses on performance in the arts, business, education, medicine, science and sport. The CPS' vision is that understanding how skilled performers meet the distinctive challenges of their work can serve both as a source of inspiration and a rich resource for research.

For more information and to take part in the HEartS survey, visit the **Centre for Performance Science website** and follow **#HEartSMusic** on Twitter.

Leading Your Technical Team

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

Leading Your Technical Team & Building on Your Leadership Skills

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**

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.

Leading Your Technical Team has a long and well respected history. It has been running for over 30 years with more than 2,000 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.
- Influencing skills and analysing your network.
- Managing and leading your team through change.
- People management issues & case studies.
- Emotional intelligence and its effect on leadership and team members.

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 instituion or at a suitable venue, if a number of attendees from a single institution wish to undertake the courses. Please contact Wendy Mason (T: 0114 276 3197 E: office@istonline.org.uk).

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 leading, 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.

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 instituion or at a suitable venue, if a number of attendees from a single institution wish to undertake the courses. Please contact Wendy Mason T: 0114 276 3197 E: office@istonline.org.uk).

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 Oxley

Kevin is the Programme Director for the LYTT & BYLS courses, which are now run through the Institute of Science & Technology (IST). He is the Head of Technical Services in the Faculty of Health Sciences at the University of Hull. He began his career at the University of Sheffield as a trainee Medical Laboratory Scientific Officer over 38 years ago and has subsequently experienced a series of diverse technical roles within the Medical School. Over the last 17 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 university wide in Sheffield before moving to Hull in May 2018. Kevin is actively involved in both promoting and delivering staff development and training at Sheffield and Hull. Kevin is a member of the Executive Board at the IST and promotes and assesses Professional Registration for both the IST and the Science Council.

Lisa Woods

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

Members' feedback

Andy Kowalski tells us how he has developed his public speaking skills

One of the ways we technologists, technicians and scientists can communicate our views on subjects which are dear to our hearts, and which will benefit others, is by speaking at events and giving presentations. This can be delivered in a number of different ways such as via PowerPoint presentation or a formal prepared talk, and it is usually aimed at getting your point across to a dedicated audience.

I felt that in my job as STEM Coach and Mentor I could be addressing not just individuals but also much wider and bigger audiences.

I enrolled on a programme to develop my presentation skills after seeing a stall outside a community centre in Loughborough, where I live, for a local Speakers Club. Part of that programme, to learn the basics, was to attend a number of presentations prepared by seasoned speakers. In January, February & May of this year I delivered some of my own talks on topical items. Each speech of my presentations had an introduction, a main body and a conclusion.

Some of my talks that may be of interest to IST members are those that I did on the importance of doing Safety Risk Assessments in the workplace, and the consequences of not doing them, or when they are not available, simply missing!

I also delivered a presentation on the work that I currently do, where I outlined coaching and mentor origins from Anglo-Saxon times, how coaching and mentoring helped me as an individual and how I now use it to help unlock people's potential. I also talked about the International scope of my work, and found that my audience was surprised to learn that a large percentage came from African states, India and Pakistan. I am a referred Mentor by the Royal Society of Chemistry (RSC) and have two Mentees, one in Cameroon and the other in Uganda.

My talk was reported in the local press, and I had very good feedback from the programme's speech assessor. Developing my public speaking skills has really helped me to convey my message at recently held local networking events.

Andy Kowalski MRSC, MIScT, FCMI

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
Sam: Robotics technician.

Billie: Insoles technician.

Inside front cover
Victoria: Vacuum technician.

Back cover
Jess: Chemical Engineering Technician.

Victoria: Vacuum technician.

Inside back cover
Billie: Insoles technician.

All images credit: Technicians Make it Happen *For more information go to:* ***technicians.org.uk***


265KG
MAX LOAD
PER SHELF