

The Professional Body for Technical, Specialist, and Managerial Staff



The Journal Winter 2023

The Journal

The Official Journal of the Institute of Science & Technology

The Professional Body for Specialist, Technical and Managerial Staff ISSN 2040-1868

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Contents

Editor's welcome	Joan Ward	2
Chairman's view	Terry Croft MBE	3
President's view	Helen Sharman CMG OBE	4
New members and registrations	IST Office	5
IST organisation	IST Office	9
Lab Plastics and a Circular Economy	Lisa McMillan	14
Lifting the Lid of the Petri Dish: Science of microbial culture media	Tim Sandle	17
People and places: some reminiscences of 34 years with the IST	Alan Gall	24
Illuminating the Future: Nobel Prize in Chemistry celebrates Quantum Dot discovery and the Path to Innovation	Amro Heikal	29
Revolutionizing the treatment of disease: An introduction to Advanced Therapy Medicinal Products	Tim Sandle	31
Advancing Technical Excellence: NTDC/HEaTED commitment to Higher Education Technicians	NTDC	36
Is Demographic detection AI unsuitable in its current form?	Beckett LeClair	38
Technical News in the UK	IST Office	41
IST Technical Conference 2023	IST Office	44
IST Network Groups: AI, Women in Tech and Scottish	IST Office	52
Member News	IST Office	56
Professional accreditation for AI and Creative Practitioners	IST Office	59



The Journal

The Official Journal of The Institute of Science & Technology December 2023

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ISSN 2040-1868

Editor's welcome



Joan Ward, MBA, FIScT IST Deputy Chair & Acting Editor

Welcome to the 2023 edition of IST 's Journal. The Journal is now published annually and is scheduled to coincide with the Christmas break. We are repeating our publication as an e-Journal and as reported previously, this is the format that we will continue using in the future.

In addition to our Journal, we will continue to publish articles and news in our online TechMag periodical and on our website. We also publish and circulate an ebulletin on an ad-hoc basis, which comprises a series of short links to articles, events and news relevant to the technical community.

My thanks go to this edition's contributing authors for their excellent articles.

In this edition there is an interesting article from Alan Gall, our archivist, in which he reminisces about his 34 years of membership of the IST, listing some of the people and places that have been important for us. Amro Heikel provides a fascinating article about the steps that eventually led to the 2023 Nobel Prize in Chemistry which recognised a ground-breaking scientific achievement that unveiled the incredible potential of quantum dots. There is also an article from one of our newer members, Beckett LeClair, which asks the question: Is AI-based demographic detection sustainable in its current form? For those with a in interest in AI this article talks about the mechanisms and use of this demographic modelling mechanism. We also have an interesting article from our AI Special Interest Group Chair, Dr Marie Oldfield about AI Practitioners, regulation and ethics.

We also include a review of our very successful Technical Conference and thank Tony Roberts for his view of the event from a host's perspective, and for his invaluable support in the organisation and delivery of the event. We are grateful to Tim Sandle, a frequent contributor, for a couple of articles, one of which explores the contribution of Advanced Therapy Medicinal Products (ATMP's) in revolutionising the treatment of disease. His second article explores the science of microbiological culture media.

Lisa McMillan provides an insight into lab plastics and potential mechanisms for the disposal of over 5 million tonnes of waste generated by the HE sector bioscience research labs. We also welcome an article from our partner affiliate, NTDC, which reflects on their work in advancing technical excellence across the technical community. It is particularly gratifying to see that NTDC's training arm, HEaTED, is still going strong after 22 years, HEaTED having been set-up initially by the IST, under our former Chair, the late John Robinson.

In our Members News we are delighted to report on the new Fellowships that are to be awarded in the New Year; all excellent electees who contribute much to the IST and the technical community, and we look forward to working closely with them in the future. We are also proud to announce some awards made to our members; James Fox (CSci) Rae Freestone (RSci) and Abigail Mortimer (RSciTech) who were all recognised as winners of their respective categories in the Science Council's CPD Awards 2023.

I wish to thank our Editorial Team for continuing to provide support in reviewing our articles. In addition, I would like to thank JP Ashton-Kinlin for his hard work and expertise in designing and compiling this edition of the Journal. The IST's Executive is actively seeking a replacement Editor(s) and will very much welcome enquiries from any member who may be interested in the role.

We like to think our publications have evolved into what are now quality publications, with a style and content that reflects our unique standing as a professional body with an extremely diverse and vibrant technical community membership. Our publications provide us with opportunities to invite our members and guests to present and publish articles, papers, and news items that will be of interest/relevance to our broad ranging membership. We welcome article submissions from all and any areas of technical interest, e.g. creative industries, digital, engineering and science technologies. We like to cover existing, historical, and new technological advances and unusual aspects of science, technology, engineering and the arts. And we particularly want to



istonline.org.uk/the-tech-magazine

encourage technical personnel to publish for the first time, as part of their career development.

If you are interested in learning more about the editorship role then please do get in touch.

Email us at <u>office@istonline.org.uk</u> in the first instance.

Why not take a minute to check out the IST's shorter, periodic TechMag magazine, and get up to date news of what is happening in the technician community. Subscribe free and follow the links to our series of periodicals and have a look at what we have been doing and the things we have planned for the near future.

We are always happy to include short articles and news items in the IST's TechMag that you feel would be of interest to the technical community, or if you would like to promote a technician event or advertise a job vacancy. Please do get in touch our IST Office at office@istonline.org.uk.

I hope you enjoy this edition.



Chairman's view



FISCT, CSci, IST Chairman

A Christmas Message from the Chair

I am pleased to say 2023 has been an excellent year for the IST with the programmes and events that our dedicated team of volunteers have delivered. This year has marked our 75th Anniversary with the annual conference

celebrating and highlighted the changing roles of technicians since our foundation. Delegates who took part in our conference at London South Bank University (LSBU), had the opportunity to hear from a variety of speakers focusing on the changes over the

variety of speakers focusing on the changes over the past 75 years, as well as taking a glance at the future from new technologies and equipment to the impact of Artificial Intelligence.

Delegates at the opening of the 2023 conference

With over 350 delegates the day was packed with workshops, tours and events that served the broad interests of technicians, managers and specialists.



Creative workshop delivered by creative technicians

With our key sponsors and exhibitors providing the opportunity to view the latest equipment and services available to our community, the company representatives were kept busy all day.



Sponsors and Exhibitors are a key part of our conferences and always appreciated by our delegates

The opportunity wasn't missed by delegates to catch up with friends, colleagues and first-time attendees and to have the chance to network, share good practice and discuss the issues faced by technical staff from a variety of sectors.



Networking was the order of the day with delegates able to catch up on the latest news from across the sectors and renew old friendships and create new ones

Two new accreditation frameworks were announced at this year's conference; the Creative Industries & Technologies Practitioner Registers and the AI Practitioner Registers. Further information is <u>now</u> <u>available on our website</u>

A big thank you is given to our keynote speakers, presenters, sponsors and exhibitors who made the day so memorable for our members and delegates. I would also like to thank our President, Dr Helen Sharman for chairing the conference and for her continued support and dedication to the IST.

My gratitude is also extended to Tony Roberts (LSBU), London South Bank University, the IST conference team and all our volunteers for their significant contributions in ensuring the conference was such a resounding success. Discussions regarding the 2024 conference venue are well underway. I look forward to catching up with you all at what will be another excellent conference focusing on current issues as well as providing high quality workshops, presentations and events. Once again, delegates will have the opportunity to network with colleagues, sponsors and exhibitors. Further information will be available shortly at <u>http://istonline.org.uk/</u>

Congratulations to our IST members who were given CPD awards at this year's Science Council awards ceremony. Congratulations to the recently elected IST Fellows; Murray McMonies, Alicia Colson, John Amaechi OBE and David Smart, so well deserved.

We are always interested in hearing from members who would like to become more involved with the IST and we welcome any such offers of support. The IST is a not-for-profit organisation, and we rely heavily on the support from our many volunteers, including our Executive Board (all members of the Board occupying voluntary, elected roles), committee members and project teams, through to contributors to our Journal, TechMag and website. If you would like to play a part in YOUR professional body, then please contact us via <u>office@istonline.org.uk</u> or contact me directly at <u>t.croft@istonline.org.uk</u> to discuss further.

I know that it has been a hard year financially for many of our members with raised interest rates, high inflation and an increase to the cost of living. To this end, the IST Executive have agreed to continue to hold membership fees at the current level for 2024 and are also looking at how we can bring in split payments through direct debit to allow fees to be spread. If you have any concerns regarding your membership fees and renewal, please email the office for further help and advice.

Despite the uncertainty that currently surrounds us, I am looking forward to 2024. I believe the new year will continue to be full of opportunities and new horizons for technicians, specialists and technical managers. The IST is here to support you on your career pathway and guide you in any way we can in these difficult and challenging times. Please remember to visit the IST website to keep up to date with news and events specifically designed for you and the technical community.

A final thought as this year comes to a close is to remember those people who are suffering from past tragic events and those that are still affected by ongoing conflicts raging around the world. Over recent years, the nation and the global community has been rebuilding from the personal loss of family members, friends and colleagues as well as the economic impact caused by so many tragic events. This has been further compounded by the war in Ukraine, the energy crisis and the country falling into recession. Sadly, more tragic events continue to blight communities in the middle East and our thoughts and prayers go out to all families suffering at this time. Maybe nature is trying to tell us that we should be coming together in the urgent fight against climate change rather than fighting each other. Nature has demonstrated, especially over the last year, how our planet is extremely fragile and how we are now subjected to extreme climate events which affects all of mankind. Hopefully, the world leaders will at last realise the need for us to work together to win this battle and provide some firm plans from the COP28 UN Conference. What a gift that would be for humanity as we celebrate Christmas and wish for a peaceful and better New Year.

Wishing you all a very Happy Christmas and a peaceful and rewarding 2024.





President's view



Helen Sharman, CMG, OBE, FRSC, FIScT IST President

As we come to the end of another year, the IST is in a great place to support members to be your best, with more opportunities than ever for great career development and advice. With the latest news from Terry Croft and the team about the Creative Arts Register, now we are recognised as a key professional body for technical and specialist

support in this area as well. Further, the AI Group's launch of the AI Professional Register sets the scene for even more great work in this area.

The IST has also been working with a number of organisations to enable them to understand and appreciate technical roles and to implement career progression pathways. It is heartening to see some super employer engagement with their technical community. Do let us know your stories so that we can learn from the good practice and, if you're happy for us to do so, there is the opportunity to include them in in one of the IST's publications. However, a number of delegates at this year's conference did say that progress had been slow in recognising the value of their technical employees in their institutions and organisations. That opportunities for training and development, recognition for their contribution to research papers, the opportunity to attend conferences and workshops were not forthcoming. The IST is here to support and advice our members, so if you tell us what is going on (or not, as the case may be), we may be able to offer some assistance in addressing these issues. Don't suffer in silence! Please remember you can contact our team at office@istonline.org.uk at any time. It's good to talk.

On the whole, though, many of us can look forward with optimism to the coming year. Sadly, this is not the case for everyone in the world, and the continued fighting in Ukraine, added to the recent escalation of issues in the Middle East, are just two of many armed conflicts happening in the world. Our thoughts are with everyone who has been affected by these events, and we hope for a quick and peaceful end to the violence. There is a lovely quote by the first Saudi astronaut, Sultan bin Salman bin Abdul-Aziz Al Saud:

"The first day or so we all pointed to our countries. The third or fourth day we were pointing to our continents. By the fifth day, we were aware of only one Earth."



Sultan bin Salman bin Abdul-Aziz Al Saud

We might think we are not able to influence matters on a global scale but every time we show kindness to someone in need, when we act against discrimination and prejudice, when we support our community to do good (be it at work or elsewhere), we are continually lifting humanity. Many years ago, the polar explorer and environmental campaigner Robert Swan helped me to start out on my own after my spaceflight. When I asked him how I could repay his kindness, his reply was, "Do something to help someone else, when you can." The message was soft but very clear - we might each be one individual but together we can have a great positive effect on the world.

With best wishes for a happy Christmas and a positive New year.



Run by technicians (iST) for all technicians

JOIN OUR MEMBERSHIP AND RECEIVE 50% OFFI THE FOLLOWING YEAR WHEN YOU INVITE A COLLEAGUE AND THEY BECOME A MEMBER



HEaTED SUPPORTS

Technician Commitment

RSciTech RSci CSci

New members and registrations

New members December 2022-December 2023

No.	Name	Grade	No.	Name	Grade
T16691	Miss S Coggin	MIScT	T16742	Mr A Aminu	MIScT
T16692	Mr N Ahmed	MIScT	T16743	Mr S U Ibrahim	AssocIScT
T16693	Ms N J Dyson	MIScT	T16744	Mr S A Bashir	AssocIScT
T16694	Dr D Chakraborty	MIScT	T16745	Mr A H Imam	AssocIScT
T16695	Ms C Barber	MIScT	T16746	Mr J Kellner	MIScT
T16696	Miss G Richards	MIScT	T16747	Mr A Sada	MIScT
T16697	Mr A J Hamilton	AssocIScT	T16748	Mr A Yahaya	AssocIScT
T16698	Dr P W Snow	MIScT	T16749	Mr L Babangida	AssocIScT
T16699	Mrs S E Hansford	MIScT	T16750	Mr H B Galadima	MIScT
T16701	Mrs A Brown	MIScT	T16751	Mr S A Abdullahi	MIScT
T16702	Ms A Outred	MIScT	T16752	Dr N Evens	MIScT
T16703	Mr C D McCreanor	MIScT	T16753	Mr H Ismail	AssocIScT
T16704	Dr V Pavlika	MIScT	T16754	Mr M J Harbau	AssocIScT
T16705	Mrs J H Tulloch	MIScT	T16755	Mr U Ibrahim	MIScT
T16706	Miss B A Sheppard	MIScT	T16756	Mr J D Richmond	MIScT
T16707	Mr A Worthington	MIScT	T16757	Mrs D Ralph	MIScT
T16708	Mr R Burton	MIScT	T16758	Miss L Clarke	MIScT
T16709	Mr A Sullivan	MIScT	T16759	Mrs A Wood	MIScT
T16710	Mr E Shamshiri	MIScT	T16760	Miss R Grimmer	MIScT
T16711	Mr R Twiringiyimana	MIScT	T16761	Mr A Turner	MIScT
T16712	Mr E Vaikosen	MIScT	T16762	Ir. Ts. EUR ING C P Lean	MIScT
T16713	Mr K T Makar	MIScT	T16763	Miss A Giliova	MIScT
T16714	Mr S L Yakubu	MIScT	T16764	Dr S A Pearson	MIScT
T16715	Mr K Andoh-Payin	MIScT	T16765	Miss A Sauvadet	MIScT
T16716	Mr K B Omoloso	MIScT	T16766	Mr M Detyna	MIScT
T16717	Ms R Laverick	MIScT	T16767	Mr J N Moore	MIScT
T16718	Mrs B N Duru	MIScT	T16768	Dr J Bincalar	MIScT
T16719	Mr S Marston	MIScT	T16769	Mr T A Yahaya	MIScT
T16720	Mr C R Ford	MIScT	T16770	Mr I Badamasi	AssocIScT
T16721	Mr L Lincoln	MIScT	T16771	Mr J Dalton	AssocIScT
T16722	Mrs I O Ibukun	MIScT	T16772	Mr A Hamza	MIScT
T16723	Mrs R A Abdul-Waheed	MIScT	T16773	Mr R Dougan	MIScT
T16724	Dr R E Fairhurst	MIScT	T16774	Mr SRN Barnes	MIScT
T16725	Mr S Salisu	AssocIScT	T16775	Miss N A Moseley	MIScT
T16726	Mr B V LeClair	MIScT	T16776	Dr M R Basir Khan	MIScT
T16727	Mr D I Akula	MIScT	T16777	Mr D J Booth	MIScT
T16728	Mr I Musa	MIScT	T16778	Ms M Pritchard	MIScT
T16729	Mr A Inuwa	AssocIScT	T16779	Assoc. Prof. Ir. Ts. Dr P K Ng	MIScT
T16730	Mr A M Adamu	MIScT	T16780	Mr D Patrick	MIScT
T16731	Mr I Washbourne	MIScT	T16781	Miss S J Delvarr	MIScT
T16732	Mr M K Bello	AssocIScT	T16782	Dr T Killelea	MIScT
T16733	Mr W Surradge	MIScT	T16783	Mr D Kennedy	MIScT
T16734	Mrs L Bedder	MIScT	T16784	Dr D Taylor	MIScT
T16735	Mr P Wakelin	MIScT	T16785	Mr A M Boucher	AssocIScT
T16736	Miss S Hamisu	AssocIScT	T16786	Miss A Oulton	MIScT
T16737	Mr B Burrill	MIScT	T16787	Mr S Whitehouse	MIScT
T16738	Mrs N A Danmusa	AssocIScT	T16788	Mr B Li	MIScT
T16740	Mr G Bird	MIScT	T16789	Miss H M Gambo	MIScT
T16741	Dr B Senapati	MIScT	T16790	Mrs J A Z Olayemi	MIScT

No.	Name	Grade	No.	Name	Grade
T16791	Mr B Yahaya	AssocIScT	T16801	Mr R Fanthom	MIScT
T16792	Mr C Harris	MIScT	T16802	Miss M Muir	MIScT
T16793	Mrs H A Abubakar	AssocIScT	T16803	Mr T Haigh	MIScT
T16794	Mr N W B Donaldson	MIScT	T16804	Mrs D W Ampitan	MIScT
T16795	Mr K F Durrant	MIScT	T16805	Mr J R Wix	MIScT
T16796	Mrs M Akin-Roberts	AssocIScT	T16806	Mr Z K Lawan	AssocIScT
T16797	Mr N Guthrie	MIScT	T16807	Mr T A Carson	MIScT
T16798	Dr E Gonzalez Escobar	MIScT	T16808	Mr J A Strong	MIScT
T16799	Ms J Coles	MIScT	T16809	Dr E Agnew	MIScT
T16800	Mr S Ablett	MIScT			
			Total 117		

Fellowship Upgrades

1

No.	Name	Grade	No.	Name	Grade
T16001	Mr J Amaechi	FIScT	T16543	Dr R A Saldanha	FIScT
T16555	Mr M J McMonies	FIScT	T13399	Mr D C Smart	FIScT
T16588	Dr A J M Colson	FIScT			
			Total 5		

Science Council New Registrations

Membership No.	Name	Grade
T15121	Dr L Woodbine	CSci
T15719	Dr Y Liu	CSci
T16037	Miss A J Hayton	CSci
T16331	Dr I Artamendi	CSci
T16543	Dr R A Saldanha	CSci
T16555	Mr M J McMonies	CSci
T16642	Dr E Moyce	CSci
T16657	Dr J Uguna	CSci
T16692	Mr Nazeer Ahmed	CSci
T16694	Dr D Chakraborty	CSci
T16695	Ms C Barber	CSci
T16699	Mrs S Hansford	CSci
T16724	Dr R E Fairhurst	CSci
T16734	Mrs L Bedder	CSci
T16762	Ir. Ts. EUR ING C Peng Lean	CSci
T16776	Dr M R Basir Khan	CSci
T16779	Assoc. Prof. Ir. Ts. Dr P K Ng	CSci
T16798	Dr E Gonzalez Escobar	CSci
T16799	Ms J Coles	CSci
T14940	Miss J Porter	RSci
T16190	Miss A K Lister	RSci
T16190	Miss A Lister	RSci
T16494	Dr A Roy	RSci
T16526	Mr P E Vasquez-Aguilar	RSci
T16693	Ms N J Dyson	RSci

Membership No.	Name	Grade
Г16696	Miss G Richards	RSci
T16701	Mrs A Brown	RSci
Т16764	Dr S A Pearson	RSci
T16765	Miss A Sauvadet	RSci
Т16766	Mr M Detyna	RSci
T16778	Ms M Pritchard	RSci
Г16797	Mr N Guthrie	RSci
T16800	Mr S Ablett	RSci
Т16606	Mr O Jowett	RSciTech
Г16622	Mr J Jeyaneethi	RSciTech
Г16672	Dr S Bose	RSciTech
T16691	Miss S Coggin	RSciTech
Г16703	Mr C D McCreanor	RSciTech
Г16717	Ms R Laverick	RSciTech
T16758	Miss L Clarke	RSciTech
T16759	Mrs A Wood	RSciTech
T16760	Miss R Grimmer	RSciTech
T16761	Mr A Turner	RSciTech
Т16763	Miss A Giliova	RSciTech
Г16775	Miss N A Moseley	RSciTech
Г16777	Mr D J Booth	RSciTech
T16801	Mr R Fanthom	RSciTech
Г16802	Miss M Muir	RSciTech
Г16803	Mr T Haigh	RSciTech

Total 49



ARITIFICIAL Intelligence

Registered Technician RTECHACA Artificial Intelligence Registered Practitioner RRPAA Artificial Intelligence Advanced Practitioner

APA Artificial Intelligence

WORKING IN AI?

AI AND ETHICS?

INTERESTED IN AI?

INTERDISCIPLINARY AI?

WITH IST MEMBERSHIP





Registered Practitioner
RPCIT
Creative Industries & Technologies



CREATIVE OR ARTS BASED?

EXPERTISE IN THE FIELD?

HE OR INDUSTRY?

BACKED BY CREATIVE UK

WITH IST MEMBERSHIP

SCIENCE & Engineering

RSciTech Registered Science Technician

> RSci Registered Scientist



RESEARCH BASED?

WORKING IN TEACHING?

SPECIALIST OR MANAGER?

SCIENCE COUNCIL BACKED

WITH IST MEMBERSHIP

ST, the only Professional Body to offer recognition across 3 vital technical specialities



IST Journal Publication

Back copies of our journal publication are viewable online:

istonline.org.uk/ist-journal-publication

Article submissions for the IST Journal & the TechMagazine

The IST Journal is a quality annual publication. Its style and content strongly reflect the 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: office@istonline.org.uk

The guidelines for article submissions for the IST Journal and TechMag are:

1. submission deadline for the Journal should be mid October, with deadlines for the TechMag being 31st April and 15th August.

2. Your article should be submitted electronically in Microsoft Word 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). **Authors must have permission to use any images supplied and need to include credits if required.**



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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 (or TechMag) Article Submission" and the article and separate images sent with it as email file attachments.



IST Organisation

Executive Board (December 2023)



President: Helen Sharman CMG OBE FRSC FIScT

Helen Sharman is the UK Outreach Ambassador at Imperial College London and a world-class inspirational speaker. She became the first British Astronaut in 1991, when she launched on a Soyuz rocket to carry out experiments on the Mir Space Station. After her return from space, Helen spent many years communicating science and its benefits, winning prizes for radio and TV programmes and for her inspirational talks on STEM, leadership, teamwork and problem solving. More recently, Helen started a new career in management, leading a research group at the National Physical Laboratory and then as Technical Manager for Science, Engineering and Computing at Kingston University London. She was the Operations Manager of Imperial College London's Chemistry Department before moving into Imperial's Outreach Team. **E: office@istonline.org.uk**



Chairman: Terry Croft MBE FIScT CSci

Terry is the Chairman of the IST. He is passionate about, and is committed to, the technical community. His work involves promoting the professionalisation of the technical workforce. He brings a wealth of experience to the board through his involvement with the wider sector and as the Founding Director of the National Technician Development Centre for Higher Education. **E: t.croft@istonline.org.uk**



Secretary: Lucy Hudson FIScT CSci

Lucy is the IST Secretary, and has responsibility for ensuring that we comply with legislative requirements and that we maintain suitable official records, and also for the coordination of our Executive meetings and documentation. Lucy is the Operations Manager in the Dept. of Biology at University of York. She is a Trustee at The Royal Society of Biology, Fellow of the IST, & external advisor for the National Technician Development Centre. **E: sandrataylor@istonline.org.uk**



Deputy Chair & Finance Officer: Joan Ward FIScT

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

E: joanward@istonline.org.uk



Education Officer: Arthur Nicholas FIScT

As Education Officer, Arthur maintains knowledge of vocational training and qualifications for technical practitioners. He also participates in regional and national development programmes. Arthur is involved in the development and delivery of technician training and manages the IST's service to employers to validate their in-house training schemes. Arthur is a Trustee of the Science Council and a Specialist Advisor to the National Technician Development Centre (NTDC).

E: arthurnicholas@istonline.org.uk



Diversity & Equality Officer: Marie Oldfield FIScT CSci

Marie is the Institute's Diversity & Equality Officer and works to ensure that the IST operates in line with the principles of diversity, equality, and inclusion, and to measure progress in that regard.

E: marieoldfield@istonline.org.uk



Registrar: Michelle Jackson FIScT CSci

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

IST Advisors



Executive Advisor: Lee Shunburne FIScT CSci

Lee is Department Manager at the University of Sheffield, an IST Fellow and is an assessor for professional registration at CSci level and sits on the Science Council's Registration Assessment Committee.



Assistant Registrar: Dr Kranthi Maniam FIScT CSci

Dr Kranthi Maniam is the Marie Curie Fellow at the Materials Innovation Centre- University of Leicester, UK and also works as a Senior Project Leader -Technology at TWI limited, UK. He is active in the scientific community as peer reviewer and serving as an executive team member in IET-Tribology Network Community, Science Committee member in IMF, contributes to IST as common application process assessor, continuous professional development assessor, professional and personal development (PPD) audit reviewer.



Executive Advisor: Russell Wilson MIScT RSci

Russell is a Senior Laboratory Technician in Sport and Exercise Science at Heriot-Watt University and provides outreach support for the IST. Russell is the Scotland Regional coordinator and in the process of formally setting up the IST Scottish Network Specialist Group and has made a significant impact to technicians across the Scottish universities.



Fellowship & Overseas Advisor: Derek Sayers FIScT FInstLM FRMS

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



Executive Advisor: John Dwyer FIScT

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



Executive Advisor: James Trout FIScT CMgr RSci

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



Executive Support Consultant: John Paul Ashton-Kinlin MIScT RSci

John-Paul currently runs a number of businesses in different sectors; medical events, property and marketing/training. JP worked as a technician in Industry and in HE and provided support in advisory capacities to the IST, NTDC and HEaTED. He supports the IST with various projects.



IST Archivist: Alan Gall BSc MSc MMath MInstP MRSC FIET FIScT CPhys

Alan has been IST Archivist since 2004. Originally a laboratory assistant, he has worked in industries concerned with edible oils, food additives, polymer stabilisers, electroplating and explosives. He is currently a company director involved with magnetic materials, electrical engineering and general mechanical engineering. Contributions to the Journal began in 2003 with an article on the Manchester University technician William Alexander Kay. He has provided regular articles since then.

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Lab Plastics and a Circular Economy

Lisa McMillan



Figure-1: Presenting at the Technicians' Conference at Queens University Belfast in 2020.

HE Sector Biological Science research labs generate an estimated 5.5 million tonnes of plastic waste annually. If we consider Industry and the NHS, volumes of such contaminated plastics enter further orders of magnitude.

Globally, the most common approach to disposal of lab plastics is incineration. Just imagine what a difference it could make to the environment if these plastics could instead be safely recycled and made part of a circular economy? My colleague Jo Brown and I are determined to further contribute to making this goal a reality.

During 2019 - following consultation with Napier's waste contractor Enva and development of a decontamination process - we began recycling the plastics generated in our labs. This pioneering and innovative recycling initiative has to date re-routed 3.5 tonnes of plastic from general waste to dry mixed recycling; the scope and extent of the project is, to our knowledge, unique.

Sharing our work quickly became a key aspect of the initiative. Our first presentation to a technicians' conference at Queens University Belfast in 2020 gave a first glimpse of what we had tapped into.



Figure-2: Recycled laboratory plastics.

We received an overwhelming response from others keen to make change in their own labs. In-house since then, associated improvements to lab sustainability are now a key feature of the university's progress towards meeting net zero obligations. Having led on Napier signing up to The Laboratory Efficiency Assessment Framework (LEAF), it's great to see our labs recently achieving 6 awards and demonstrating savings of £6,900 and 11 tonnes of CO2! The work has even influenced the institutions waste contract tender process, ensuring future continuity of the recycling.

Interest has continued to grow and to date we estimate to have had the privilege of communicating the work to more than 300 organisations. To be asked to share the work at such prestigious events as the Royal Society of Biology's 2022 Accreditation Conference and with key organisations such as the Institute for Cancer Research is so encouraging. Vitally, we continue to share and exchange best practice with many institutions and the ripple effect of positive change is a real motivator.



Figure-3: Lisa McMillan and Jo Brown in front of the Edinburgh Napier University's waste contractor Enva.

The potential for change that this work represents is feeding a paradigm shift across the HE sector and beyond, leading many to question long established norms of lab waste disposal. This significant opportunity for change has been recognised by the THE Times Higher Education Awards 2023 with a shortlisting in the Outstanding Contribution to Environmental Leadership category.



Figure-4: Shortlisted for the THE Times Higher Education Awards 2023.

If that all sounds positive it is (!), but here's the thing. Since we began sharing our work the question most asked, unsurprisingly, is 'how do you decontaminate the plastics'.

People really want to know the fine detail in terms of trying to replicate in their own labs.

Despite an obvious appetite for change, progress elsewhere has been slow. One key reason for this is validation; people want to see our sterility proven.

'It's no longer about what we do and how we do it, rather it's about proving the efficacy of what we do.'

To this end the Institute of Science and Technology are kindly supporting development of this next phase of work, this support is hugely appreciated. This will facilitate some fundamental groundwork and the subsequent publication, by peer review of our validation processes.

This is only a beginning, but being able to validate our sterility process will be a game changer. It will provide a crucial piece of the jigsaw that will showcase these plastics (recall the quantities mentioned above!) to be a safe potential alternative to virgin resources in downstream manufacturing processes. This in turn can help influence relevant future health and safety policies, recycling policies and infrastructure, necessary markets etc.

Until now, contaminated lab plastics and circular economies have rarely been part of the same conversation. We may have been quoted 'accidental pioneers' in lab plastic recycling but the time is coming where through our efforts we can truly begin to move this conversation on.

Useful Links:

https://www.microbiologyresearch.org/content/jo urnal/acmi/10.1099/acmi.0.000173? crawler=true

Others that have since made steps to replicate or produce SOPs to reduce lab plastic at their institutes (e.g York, Bristol):

https://thebiologist.rsb.org.uk/biologistfeatures/how-to-reduce-your-lab-s-plastic-waste https://www.theguardian.com/environment/2019 /nov/10/research-labs-plastic-waste

Author:

Lisa McMillan is a technician within the School of Applied Sciences, Edinburgh Napier University. Together with her colleague Jo Brown she has pioneered an innovative recycling system which has to date rerouted 4 tonnes of decontaminated laboratory plastics from general waste to dry mixed recycling. Lisa and Jo have also advised around 300 organisations on lab sustainability improvements. This work is carried out in addition to Lisa and Jo's formal roles as teaching technicians.



Applying for IST Fellowship

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 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/or the UK technical workforce and the nature and extent of that potential contribution will be taken into account when Fellowship applications are assessed and renewals reviewed. 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 will expect Fellows to be able to evidence how and when they contributed in support of the IST and/or the technical community if such activities are not already known to us. 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: <u>istonline.org.uk/membership/fellow</u> **E: office@istonline.org.uk**

Lifting the Lid of the Petri Dish: The Science of microbiological culture media

Dr Tim Sandle, PhD, FIScT

Introduction

In the natural environment, microorganisms have adapted to the habitats most suitable to their needs. To replicate these conditions in the laboratory, such requirements are met by the use of culture media (Srivastava and Sirvastava, 2003). The common range of nutritional and physical requirements for microbial growth include:

- Water
- A source of energy
- Sources of carbon (such as glucose), nitrogen (and amino acids), sulphur and phosphorus,
- Minerals and metals
- Buffer salts
- Vitamins and other growth factors.

To grow microorganisms on culture media, these factors need to be reproduced in artificial ways.

Microbiological culture media is either a solid, liquid or semi-solid composite designed to support the growth of microorganisms. It is represented as the commonly seen solid agar in a dish (the Petri dish) or liquid broth in a bottle. Liquid media are used for encouraging growth or for continuously maintaining reproduction, as with pure batch cultures for fermentation. Broths are also used for preparing cultures. Solidified media is used widely for isolation of pure cultures and is required for enumeration methods and for achieving single, pure isolates for identification.

Ideal media provides a biochemical (nutritional) environment for microbes together with a biophysical environmental, which is met based on the incubation conditions within which the culture medium is placed. But what is an ideal medium? This paper lifts the lid to see 'what is under the box' when it comes to developing and manufacturing microbial culture media.

In addition to the elements described in Table 1, E. coli cells also require trace elements in order to grow. These are elements like zinc, cobalt, and copper.



A: Turbid broth showing bacterial growth; B: Selection of broths; C: Petri dishes with agar; D: Funghi growing on agar.

Microbial growth and the relationship with culture media

In order to grow and reproduce microorganisms require biochemical factors - nutrients and a source of energy - and certain biophysical factors - ambient conditions relating to pH, atmosphere and temperature (Sandle, 2011). Take, for example, the nutritional requirements of the bacterium Escherichia coli (this organism often appears in the news as some strains are a major cause of food poisoning outbreaks). The nutrients this organism requires are shown through the bacterial cell's elemental composition. Such elements are found in the form of water, inorganic ions, small molecules, and macromolecules which serve either a structural or functional role in the cells. For E. coli the major elements consist of those illustrated in Table 1 (Hull and Hull, 1997).

Table 1: Nutrient requirements for E. coli

Element	Percentage of dry weight	Source	Cellular function
Carbon	50	Organic compounds or CO2	Main constituent of cellular material
Oxygen	20	H2O, organic compounds, CO2, and O2	Constituent of cell material and cell water; O2 is electron acceptor in aerobic respiration
Nitrogen	14	NH3, NO3, organic compounds, N2	Constituent of amino acids, nucleic acids nucleotides, and coenzymes
Hydrogen	8	H2O, organic compounds, H2	Main constituent of organic compounds and cell water
Phosphorus	3	Inorganic phosphates (PO4)	Constituent of nucleic acids, nucleotides, phospholipids, LPS, teichoic acids
Sulphur	1	SO4, H2S, So, organic sulphur compounds	Constituent of cysteine, methionine, glutathione, several coenzymes
Potassium	1	Potassium salts	Main cellular inorganic cation and cofactor for certain enzymes
Magnesium	0.5	Magnesium salts	Inorganic cellular cation, cofactor for certain enzymatic reactions
Calcium	0.5	Calcium salts	Inorganic cellular cation, cofactor for certain enzymes and a component of endospores
Iron	0.2	Iron salts	Component of cytochromes and certain nonheme iron-proteins and a cofactor for some enzymatic reactions

The essential components for growing microorganisms are examined next.

Water

Taking water first, all microorganisms require some amount of water in order to reproduce (Postgate and Hunter, 1962). It follows that with culture media water is, proportionately, the largest ingredient. The water requirements of microorganisms are described in terms of the water activity (aw) of the environment. This is different to assessing how much water, it is more with the amount of available water. For microbial growth different microorganisms have optimum and minimum levels of aw needed for survival and for cell division. In general, Gram-negative bacteria are more sensitive to low aw than are Gram-positive bacteria.

Energy sources

Energy sources can be organic or inorganic. Energy sources are important; for in order to grow in the environment or in the laboratory, a bacterium requires an energy source which is typically a source of carbon. Carbon sources, such as carbohydrates like glucose, are common energy sources and these are an important part of the composition of culture media. In addition to carbon, most organisms require small amounts of certain organic compounds for growth. These are considered as essential substances that the organism is unable to synthesise from available nutrients. Such compounds are referred to as 'growth factors.' These are not metabolised, as the carbon source is; instead, they are assimilated by bacterial cells for specific roles in metabolism.

Vitamins and growth factors

Microorganisms require ten macro-elements namely (carbon, oxygen, hydrogen, nitrogen, sulphur, phosphorus, potassium, calcium, magnesium and iron). The first six components are used in the synthesis of carbohydrates, lipids, proteins and nucleic acids; with the remaining four elements existing in the microbial cell as cations; these take part in a variety of roles. In addition to the listed macro-elements, all microorganisms require several microelements like (magnesium, zinc, copper, molybdenum, nickel and copper) (Basu et al, 2015). To achieve growth, these macro-and micro-elements need to be available within the composition of culture media.

Typical growth factors added to culture media are (DiMarco et al, 1990):

- Purines and pyrimidines: required for synthesis of nucleic acids (DNA and RNA).
- Amino acids: required for the synthesis of proteins.
- Vitamins: needed as coenzymes and functional groups of certain enzymes. A list of vitamins and their functions is tabulated below (coenzymes are derived from vitamins and other organic essential nutrients in tiny amounts).

Vitamin	Coenzyme form	Function
p-Aminobenzoic acid (PABA)	-	Precursor for the biosynthesis of folic acid
Folic acid	Tetrahydrofolate	Transfer of one-carbon units and required for synthesis of thymine, purine bases, serine, methionine and pantothenate
Biotin	Biotin	Biosynthetic reactions that require CO2 fixation
Lipoic acid	Lipoamide	Transfer of acyl groups in oxidation of keto acids
Mercaptoethane-sulfonic acid	Coenzyme M	CH4 production by methanogens
Nicotinic acid	NAD (nicotinamide adenine dinucleotide) and NADP	Electron carrier in dehydrogenation reactions
Pantothenic acid	Coenzyme A and the Acyl Carrier Protein (ACP)	Oxidation of keto acids and acyl group carriers in metabolism
Pyridoxine (B6)	Pyridoxal phosphate	Transamination, deamination, decarboxylation and racemation of amino acids
Riboflavin (B2)	FMN (flavin mononucleotide) and FAD (flavin adenine dinucleotide)	Oxidoreduction reactions
Thiamine (B1)	Thiamine pyrophosphate (TPP)	Decarboxylation of keto acids and transaminase reactions
Vitamin B12	Cobalamine coupled to adenine nucleoside	Transfer of methyl groups
Vitamin K	Quinones and napthoquinones	Electron transport processes

Table 2: Typical vitamins required by bacteria.

The most common source of vitamins, minerals, metal irons, and digested nucleic acids, is a yeast or animal extract. For example, the main ingredients of nutrient broth are beef extract and peptone. Most peptones derive from incubating milk, soy flour or meat with trypsin, pepsin, or other proteolytic enzymes, to digest the protein into a mixture of amino acids, peptides, and polypeptides. With tryptone soya broth and agar, for example, the main ingredients are pancreatic digest of casein, soyabean meal and salts. These enable microorganisms to make proteins and nucleic acids.

In addition to these essential requirements certain indicator dyes, neutralisers (to inactivate antimicrobial agents) and selective agents may be added. For plate media agar is included as the gelling agent.

Agar

Agar is traditionally derived from seaweed although there are synthetic variants. Chemically, agar is a polymer (phycocolloid) made up of subunits of the sugar galactose and is a component of the cell walls of several species of red algae harvested in eastern Asia and California. Most commonly the phycocolloid is extracted from a group of red-purple marine algae or 'seaweed' (Class Rhodophyceae) including Gelidium, Pterocladia and Gracilaria. Of these, Gelidium is the most common algae used (Armisén and Galatas, 1987). When processing the algae, impurities, debris, minerals and pigment are reduced to specified levels during manufacture.

Agar is remarkable. It forms a gel at room temperature, and it remains firm at temperature up to around 65°C. Agar melts at approximately 85°C; since this is a different temperature from that at which it solidifies - 32 to 40°C - a property called hysteresis. This means that agar can be melted, poured, and then allowed to set. Therefore, from the temperatures of 40 to 85 °C, agar can be either solid or liquid, depending on which state it was before (Woessner et al, 1970). The gelling portion of agar involves agarose, a double helical structure. Agar is typically used in a final concentration of 1-2% for solidifying culture media.

But will my microorganism grow?

There is no single medium or set of physical conditions that permits the cultivation of all microorganisms due to the huge diversity of metabolic pathways. Furthermore, many microbial species are fastidious in requiring specific ranges of pH, osmotic strength, temperature and presence or absence of oxygen (Atlas, 2004). Sometime bacteria, classed on the basis of their patterns of growth under various chemical (nutritional) or physical conditions, require exacting factors for growth. The nutritional classification of microorganisms is (Hine, 2005):

- Photoautotrophs: require light and a carbon dioxide rich atmosphere. Examples include cyanobacteria.
- Photoheterotrophs: require light and organic compounds. Examples include purple and green bacteria.
- Chemoautotrophs: require inorganic compounds, such as hydrogen or ammonia. Examples include a few bacteria and many archaea.
- Chemoheterotrophs (often simply 'heterotrophs'): require organic compounds. Examples include the majority of bacteria. Most of the bacteria that the clinical or pharmaceutical laboratory will encounter will be heterotrophic.

Oxygen

Levels of oxygen affect microbial growth in diverse ways, and this is based on redox potential. The oxidation-reduction or redox potential of a substance is defined in terms of the ratio of the total oxidizing (electron accepting) power to the total reducing (electron donating) power of the substance. Based on oxygen growth requirements, organisms can be classified as (Singleton, 1999):

- Obligate aerobe: will only grow under aerobic conditions, oxygen is required for aerobic respiration
- Microaerophile: will growth in aerobic conditions if the oxygen level not too high (below 0.2 standard atmosphere). No growth will occur under anaerobic conditions.
- Obligate anaerobe: will not grow aerobically (oxygen is toxic to the organism); will grow under anaerobic conditions
- Facultative anaerobe: will grow under both aerobic and anaerobic conditions (Oxygen not required but can be utilised when required)
- Facultative aerobe: will grow under both aerobic and anaerobic conditions (Oxygen not required but can be utilised when required)
- Aerotolerant anaerobe: will grow under both aerobic and anaerobic conditions (oxygen not required and not utilised).

This factor explains why culture media for anaerobes requires a specific composition to be added. Reducing agents are added to the media prior to autoclaving. Commonly used reducing agents are sodium thioglycollate (HS-CH2COONa) or sodium dithionite, which easily donate protons to other compounds. Redox potential is affected by pH (Oktyabrskii and Smirnova, 2012).

pН

Understanding pH and growth needs to be considered between the minimum pH, below which the organism cannot grow; the maximum pH, above which the organism cannot grow; and the optimum pH, at which the organism grows best. For example, with Staphylococcus aureus, this organism has a minimum pH of 4.2; a maximum of 9.3; and an optimal range of 7.0 to 7.5. pH is not a mutually exclusive growth determining factor. The pH can interact with factors such as aw, salt, temperature, redox potential, and preservatives to inhibit growth of pathogens and other organisms (Rosso et al, 1995). Most media is formulated to be at a neutral pH.

Temperature

As with pH, microorganisms have temperature ranges that can be tolerated. These temperature ranges can also be used as descriptors for distinct types of microorganisms (Pankowski et al, 2016):

- Psychrophiles: cold-loving organisms, defined as an ability to grow at 0oC, by virtue of having unsaturated fatty acids in their plasma membranes.
- Psychrotroph: organisms which have an optimal temperature of 10-15oC.
- Mesophiles: organisms with an optimum temperature near 37oC (the body temperature of warm-blooded animals). Typical range is 15 to 450C.
- Thermopiles: organisms with an optimum temperature between about 45oC and 70oC, due to the presence of a high G + C content in the organism's DNA
- Hyperthermophiles: organisms with an optimum temperature of 80oC or higher (some as high as 115oC). An alternative name is extreme thermophiles.

Temperature is a key factor for deciding the incubation conditions within which a culture medium is to be placed (Sandle and Skinner, 2013).

Different types of culture media

There is no standard way for grouping culture media, but there are both 'defined' and 'undefined' media common to laboratories (Sandle, 2014).

Defined media.

Defined media are composed of accurately measured concentrations of chemically defined and purified ingredients. Examples of where a defined medium is required is looking for the presence or absence of Legionella and with cultivating fastidious types of Streptococci, both of these examples relate to relating to clinical microbiology. A defined medium is a medium in which:

- All the chemicals used are known
- No yeast, animal, or plant tissue is present

With defined media, such media will contain a simple sugar for the carbon and energy source, an inorganic nitrogen source, various mineral salts and supplementary growth factors as required, such as purified amino acids, vitamins, purines and pyrimidines. Whatever the combination, the exact chemical composition of the medium is known.

Undefined media

Undefined media is sometimes referred to as 'complex media.' These are media designed to grow most heterotrophic organisms, Such media are rich in nutrients and contain water soluble extracts of plant or animal tissue. The main carbon and energy source is usually glucose. These are highly nutritious but also chemically complex and contain some undefined substances in that the exact breakdown of the ingredients is unknown. Complex media contain often protein hydrosylates which is good natural sources of amino acids, peptides and proteins in growth media. This acts as the most important source for nitrogenous nutrients. These proteins are most often obtained by enzymatic digestion or acid hydrolysis of natural products, including animal tissues, milk, plants or microbial cultures forming protein hydrolysates (or 'peptones').

An undefined medium contains:

- A carbon source such as glucose
- Water
- Salts
- A source of amino acids and nitrogen (such as beef or yeast extract)

Summary

This paper has looked at the development of microbiological culture media, to show how the complexities of microbial survival in the environment might be reproduced within the laboratory. The requirements for successful growth include those both chemical and physical.

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In order to grow successfully, microorganisms must have a supply of water as well as numerous other substances including mineral elements, growth factors, and gas, such as oxygen. Physical requirements are also necessary for growth and specific physical conditions affect the type and amount of microbial growth. For example, enzyme activity depends on the temperature of the environment; another factor is the degree of acid or alkalinity.

These chemical factors are what a microorganism needs in terms of the potential to grow on a culture medium and the physical conditions turn this potential into growth or no growth, depending upon what is optimal for the given organism. Understanding the basis of culture medium formulation and the incubation conditions is essential for recovering and growing microorganisms under laboratory conditions.

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pharmaceutical microbiologist. He is a lecturer at UCL and the University of Manchester as well as the Head of Compliance and Quality Risk Management at Bio Products Laboratory Limited (a pharmaceutical organization. Dr. Sandle is a chartered biologist (Royal Society of Biology) and holds a first class honors degree in Applied Biology; a Masters degree in education; and obtained his doctorate from Keene University.

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How to Make Wine Glass Snow Globes

Christmas Crafts: Recycle your old glasses or pop to the shop



Why not have a go at crafting your own snow globe candle holders! It is so easy and doesn't break the bank either.

WHAT YOU NEED

- Wine glass (if you don't have any you can get them from Poundland)
- Hot glue gun (you don't need a glue gun, it can be just glue)
- Figurines/ornaments (you can make these or recycle old ornaments)
- Fake snow/foam balls
- White paint
- Sturdy Cardboard (You could use a cereal box)
- Ribbon
- Candle

INSTRUCTIONS

- 1. Trace the bottom of a wine glass on a piece of thin cardboard. Cut it out. Paint it white and let dry.
- 2. Pour some fake snow or balls in the wine glass. Glue on your figurines to the cardboard circle.
- 3. Put hot glue around the rim of the wine glass then tip the figurines upside-down and press around the edges. If any snow falls out add extra hot glue.
- 4. (Optional) Paint the outside bottom rim with white paint and sprinkle with glitter or snow! If there's excess cardboard just cut it off.
- 5. Tie a bow with ribbon and hot glue it on.
- 6. Top with a candle.



This time of year, regardless of culture or background, almost everyone in our global community will be taking breaks from their routines and spending time with loved ones.

Spending time in this way is important, as breaks give us a chance to rest and reflect, and time with friends and family can fuel our sense of connection and purpose.

So, no matter how you celebrate your holiday season, we hope you enjoy some time resting.

Seasons Greetings and warm wishes from the IST Executive

People and places: some reminiscences of 34 years with the IST

Alan Gall FIScT, IST Archivist

This is partly a personal account of events during my membership and partly an indulgent trawl through

some of the early history of the IST. I have, for example, devoted much space to one individual who did much for the Institute's development, right from inception.

the Bulletin, 1 February 1975.

Table 1. Membership numbers as reported in

	1970	1971	1972	1973	1974
Applications for membership at December 31st	673	538	396	344	357
New members at December 31st	643	455	323	281	300
					í.

Joining the IST

As far as I can recollect, a leaflet promoting the IST appeared on the notice board at Wigan & District Mining & Technical College (as it was then styled). I applied and my certificate of Associate membership bears the date 10 May 1974. Perhaps with no more than a slight interest at the time, I noted that the Institute had evolved from the Science Technologists Association (STA).

It is interesting to look back at the first copy I received of the monthly Bulletin of the Institute of Science Technology, 1 February 1975. This happened to be volume one, number one, as editor R. M. Allan explained:

The Bulletin is back! In a somewhat different, updated, format however and for this reason it has been decided to call this issue the first of a new series. I hope it is the first of many because the continued survival of the Institute as a viable and vigorous organisation will be reflected in the progress of this publication.

Bankruptcy of the printers and financial constraints had suspended publication of the Bulletin for the previous three years. However, it returned in very modest form; eight A4 pages, with most of three pages taken up by advertisements. There were reports from various branches: Edinburgh & South Scotland, Bristol & District, Newcastle, Oxford & District, and London. John Potts, acting as Public Relations Officer, laid bare the decline in membership numbers (Table 1). The next Bulletin gave subscription rates, noting the anomaly that Fellows paid less than Members (Table 2).

Table 2. Subscription rates falling due1 January 1975

Grade	£
Fellow	6
Member	8
Associate Member	6
Ordinary Member	4
Student Member	1

In 1974 the IST occupied an office at 345 Gray's Inn Road, London WC1X 8PX, where Valerie D. Lenton acted as General Secretary. Over the years, the Institute relocated several times. When the embryonic Science Technologists Association first looked around for a base of operations, the Institute of Medical Laboratory Technology (now the Institute of Biomedical Science) was asked if the Institute's office at 76 Brewer Street, London W1 could be shared. The proposal had been put to the IMLT by Alfred Norman, one of the original STA founders. Despite Norman's standing with the IMLT (he had been their Chairman since 1944 and held various positions with its predecessor, the Pathological and Bacteriological Laboratory Assistants' Association) the Institute declined to grant permission.

Due to the good offices of Vincent Briscoe**[i]**, Imperial College in South Kensington made room 73 in the department of chemistry available as temporary accommodation, also providing the telephone line Kensington 4861, extension 74. The facilities were ready before 8 March 1948, the date of a circular canvassing selected technicians with an invitation to become founder members.

After ten years with the IST personal financial problems arose. My immediate reaction was to cut back on expenditure and memberships were a luxury.

Re-joining the IST

After an eventful fifteen years away, during which time the IST's registered office had changed from Staple Inn Buildings South, 335 High Holborn, London to the impressive Stowe House in Lichfield, I re-joined in 1999. The journal still ran under the title Science Technology, the editor now Ian Gray (at least one name familiar to me).

I had been inspired by reading David Wilson's book on Ernest Rutherford[ii] which mentioned some of the support staff who assisted with the ground-breaking nuclear research being carried out in the physics department at the University of Manchester. Of particular interest were Rutherford's glassblower, Otto Baumbach, and his lab assistant William Alexander Kay. After some historical investigations I submitted my first article for publication in Science Technology (April 2003) entitled "William Alexander Kay -Technician Supreme". This prompted a phone call from John Robinson, chairman of the IST since 2001. I then met up with John at the University of Manchester and found him an instantly likeable fellow, especially as he bought me lunch. His premature death in 2013 came as quite a shock.

In 2004 I applied for Fellowship with my MSc dissertation on high gradient magnetic separation. This was successful and started an increased involvement with the Institute.

Lichfield

Shortly after becoming a Fellow, an unexpected email arrived from Journal editor Ian Gray on 18 November 2004. Would I be interested in the role of archivist. This caused some consternation as I liked the idea but felt that the time spent running a business precluded me from taking up the role. Ian assured me that "everything is done by email these days". As a prelude he suggested a trip to Stowe House, where the Institute's records were housed. This didn't happen until 19 February 2005. Lichfield is a pleasant place, a cathedral city with two lakes – Minster Pool and Stowe Pool. Immediately impressive were the gents toilets at one of the car parks. If you live where I do, the very existence of public conveniences is unusual, not to mention the overall cleanliness and (wow!) presence of flowers adorning the inside and out.

Stowe House is a grade II listed building set in its own grounds, overlooking Stowe Pool, in an area called Netherstowe (Figure 1). In a ground floor room at one end of the annex building I found eight metres of shelving, home to textbooks, Institute publications and Fellowship dissertations. Further material lurked in the basement: membership correspondence, minutes of meetings, accounts, and other internal documents. Time did not permit a detailed examination of the subterranean records.



Figure 1: Stowe House in 2005, taken just after the move to Brooke House. To the left of the main building, hidden by trees, is the annex where IST records were housed. The Institute of Leadership and Management also used the building.

The dissertations were mostly concerned with the biological sciences. Perhaps the most unusual was "Shrunken Heads: A Study of the Cultural Significance and Anatomical Features" by T. F. Spence, and the longest-title award goes to C. D. Shorey's "The Development of Specific Staining Methods for the Electron Microscope Demonstrating the Localization of Some Relevant Enzymes in the Development of Endoplastic Reticulum in the Liver of the Chick Embryo".

One space saving idea suggested itself. Most dissertations were duplicated, and in some cases triplicated. One reference copy would suffice. I'm not sure what happened about these, but the imminent relocation of offices made storage capacity an issue.



Figure 2: Brooke House for sale. Photo taken by Father Patrick Comerford in 2021.

Before the end of 2005, the IST office had moved to Brooke House, 24 Dam Street, Lichfield (Figure 2). This is within musket range of the cathedral, or so a plaque above the door tells us.



Alas, the charms of Lichfield were soon to be left behind in favour of Sheffield. But next, another dip into the distant past.

Les Croker and the STA Bulletin

A name noticeable by its frequency in early Council minutes and other records is that of F. W. L. (Les) Croker. He attended the inaugural meeting of the STA on 10 July 1948 and joined with membership number thirty-five. (The distinction of being number one went to Frederick George Consterdine, whose illustrious career can be followed in a previous article[iii]). At the inaugural meeting, fourteen members were elected to form the Council. An additional three joined afterwards, including Les Croker, one of ten founder members employed by Imperial College of Science & Technology. Twenty years later he headed the ballot list for Council membership (Figure 3). The Croker family must have fallen on hard times. Francis William Croker, Les's father, is given in the 1911 census as a publisher of illustrated newspapers. However, he died in 1916 at the early age of thirtyeight and ten years later we find his window as a cook in the household of Georgina Florence Selby Smyth. [iv] Dorothy Pearl Croker, Les's sister, also found employment there as parlour maid. Les, aged ten, lived in the house with them.

MARCH, 1969				
COUNCIL BA	LLOT, 1969			
The result of the ballot for service on Council for the term beginning in April, 1969, was as follows:				
Name Croker, F. W. L. Rowland, E. O. Diaper, R. S. Davidson, Mrs. M. Massey, A. J. Pratt, G. Black, T. H. B. Bird, B. C. Green, A. T. Watkins, D. L. Page, R. C. Petrie, A. Baker, K Cane, M. E. Evans, C A. Trevarthan, A. J. Eden, R. J. Leary, E. A. Irvine, D. The first ten candidates a 473 valid ballot papers	$\begin{tabular}{c} Votes & 323 \\ 282 & 277 \\ 277 \\ F. & 266 \\ 254 & 230 \\ 226 & 225 \\ 211 & 208 \\ \hline \\ \hline \\ 202 & 194 \\ 187 \\ 186 \\ 162 \\ 142 \\ 141 \\ 139 \\ 90 \\ are therefore elected. \\ were returned. \\ \end{tabular}$			
TALBOT, ELLIS, JACK & Co. Chartered Accountants.				
Titure 2. Evidently a new law and i	data las Cualcas han da tha			

Figure 3: Evidently a popular candidate, Les Croker heads the nominees for Council membership.

There have, of course, been many who guided the Institute through its formative years and beyond, but Les Croker served longer than most and we have available a few stories from Hannah Gay and William Griffith's history of the chemistry department at Imperial College.[v]

Les started at Imperial in 1926 on a wage of 15 shillings [75p] per week. He worked in the analytical laboratory under the supervision of Frederick Edwards who had also started at a young age.[vi]

As happened in those days, he dressed in a suit (grey), which is not ideal clothing when handling chemicals without a lab coat. He recalled breaking a large bottle of silver nitrate solution, splashing the suit. The new inorganic chemistry professor, Vincent Briscoe (previously mentioned), suggested washing out the brown stains with potassium cyanide. This was done and after drying, then sending for a professional job at the cleaners, the suit returned to a presentable condition.

World War Two brought extra duties for staff at Imperial: fire watching, grenade-throwing practice, and learning how to dig people out of bombed buildings. Les Croker also had the unusual task of finding supplies of waxed dental floss. Vincent Briscoe had previously worked on developing invisible inks for MI5. This resumed with other clandestine activities, like the opening of intercepted embassy mail. Somehow, it was discovered that dental floss could be used to remove sealing wax on messages which were re-sealed after reading, and sent on their way.



The STA naturally needed to maintain contact with members and did this by issuing the STA Bulletin. Number one is dated January 1949, edited by F. W. L. Croker. This was, by any standards, a primitive affair; a handwritten title and three pages composed on a wellworn typewriter (Figure 4). Soliciting suitable content is a perennial problem for most organisations that rely on member's contributions. So too with the Bulletin. In issue three we find:

The first two Bulletins have been received with very little comment. In fact, it is a disappointment to the Editorial Board that this is so. Our colleagues in the North have been remarkably quiet, and we are hoping soon to be able to publish something from them.

Les did not remain editor for long as he shortly assumed the role of Honorary Secretary, taking over from Fred Consterdine (who resigned due to illhealth). His last Bulletin is issue four of April 1949. The editorship then passed to Robert John Fisher, described thus:

He is forty-seven years of age and is a cheerful, energetic type with a whimsical sense of humour. He is exceedingly meticulous in all that he does. When convinced that he is right it is difficult to persuade him otherwise and the Nucleus Committee named him "Molotov-Fisher".

The *Bulletin* continued to be published using typewriters of varying quality until that of April 1951, the first fully printed version. Editorship had changed again, to F. R. N. Pester. Jeff Friend, then on the Editorial Board, remarked many years later that since Pester was always called FRN, he couldn't remember his actual first names.**[vii]**

The Journal

I am immensely grateful to Ian Gray, whose telephone call in 2004 persuaded me to take on the job of archivist. This suited me quite well as I am a hoarder of information and ephemera. It has also been great fun writing journal articles. Ian relinquished the editorship, performing his last duty with the Winter 2008 issue of The Journal. Thus ended twenty-two years in the job.

Producing submissions for The Journal**[viii]** became a way of life. Because of the wide background of members, I felt free to roam randomly through diverse subjects: from butterflies to mining guano, from the pioneering days of X-rays to poisoned beer. Starting with the Winter 2009 issue came a series called "From the Archives". This ran for ten years and displayed a picture of a suitably ancient-looking, archivist-like figure. He is not me, although I may end up looking like him. The person is the Rev. E. Cobham Brewer, author of the voluminous Dictionary of Phrase and Fable (Figure 5).



Figure 5: E. Cobham Brewer, LLD, aged 85.

From Summer 2009 to the last hard copy in 2019, Ian Moulson acted as editor. We had many telephone conversations which usually involved a good deal of laughter and I do miss these sessions. I hope that I didn't interrupt his work too much. I also got to know the delightful ladies at Kingfisher House, partly occupied in 2006 as the new IST HQ. Wendy Mason and Louise Taylor were my main IST contacts on a day-to-day basis.

Collaboration is usually a rewarding process. A particularly enjoyable time was researching an article**[ix]** with Derek Sayers, Fellowship & Overseas Advisor. Derek has an immense knowledge of microscopical techniques and has spent time abroad helping universities to maintain antiquated equipment. He has been a member of the IST for twice as long as I have.

Another satisfying experience has been the soliciting of articles. This began with the willingness of Dr. Sidney Osborn to allow publication of a lecture he gave at University College Hospital.**[x]** I particularly liked his opening remark, "I have always been interested in history, and now, to my surprise, I find myself part of it." Incidentally, this resulted in a very rare "Letter to the Editor", received from Peter Mannell who worked as a technician for Dr Osborn at UCH.**[xi]**

I did not find it particularly difficult to find willing authors. One method was to approach people who had written for other scientific journals, such as Chemistry World. The late Stewart Revell also proved adept at spotting likely prospects. Some contributors went on to offer further articles. Proofreading articles has been, shall we say, interesting. This continued for a number of years until, to my relief, the task passed to others on the editorial team.

There are of course very many others in the IST story, past and present, not mentioned here. But I have set myself a limit of 3000 words, and here we are.

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Illuminating the Future: Nobel Prize in Chemistry Celebrates Quantum Dot Discovery and the Path to Innovation

Amro Heikal FIScT, CSci

The 2023 Nobel Prize in Chemistry has recognized a groundbreaking scientific achievement that has unveiled the incredible potential of quantum dots. This pioneering discovery, which promises to reshape a multitude of industries, was achieved through a series of meticulous steps and dedicated research efforts by a team of visionary scientists.

Step 1: The Quest for the Minuscule Marvels

The journey toward quantum dots discovery began with a deep-seated curiosity about the nanoscale world. Scientists involved in this research sought to explore the unique properties of materials at the quantum level. They recognized that at this scale, the behavior of materials could be profoundly different from their macroscopic counterparts, opening up new vistas of possibilities.

Step 2: Semiconductors as the Key

Semiconductors became the focal point of their investigation. These materials, renowned for their role in electronic devices, exhibited intriguing behavior at the nanoscale. The researchers selected semiconductors as the canvas for their exploration of quantum dots.

Step 3: Precision Engineering of Nanoparticles

The heart of the quantum dot discovery lay in precision engineering. Researchers mastered the art of crafting nanoparticles with incredible precision. By controlling the size of these nanoparticles down to the level of individual atoms, they unlocked the unique property of quantum dots—the ability to emit different colors of light depending on their size.

Step 4: Tailoring Colors with Precision

As they ventured deeper into this groundbreaking

research, the scientists discovered that the colors emitted by quantum dots could be precisely tuned by adjusting the size of the nanoparticles. This tunability was a pivotal breakthrough, as it allowed quantum dots to serve as customizable light sources, opening up applications in displays, lighting, and more.

Step 5: Exploring Applications Across Diverse Fields

With the basic principles of quantum dots in hand, the researchers explored a multitude of applications across various fields. From display technologies that brought richer and more lifelike colors to our screens to medical imaging techniques that advanced diagnostics and treatment, quantum dots exhibited their transformative potential.

Step 6: Sustainability and Energy Efficiency

In the realm of sustainability, quantum dots held the promise of more efficient solar panels. By optimizing the conversion of sunlight into electricity, these tiny particles could accelerate the transition toward clean energy sources, a vital step in combatting climate change.

Step 7: Targeted Medicine and Environmental Monitoring

In healthcare, quantum dots emerged as agents of precision medicine. They were employed as carriers for drug delivery, enabling targeted treatment with minimal side effects. Simultaneously, quantum dots found their place as environmental sentinels, capable of detecting pollutants and hazardous chemicals in real-time, thus safeguarding our ecosystems.

The Nobel Laureates: Celebrating Dedication and Innovation

The Nobel Prize in Chemistry for Quantum Dot Discovery pays homage to the relentless dedication and innovative spirit of the scientists who embarked on this transformative journey. Their meticulous research, which began with a quest to understand the nanoscale world, has given rise to quantum dots, a technology with boundless potential to revolutionize industries and improve lives.

In conclusion, the Nobel Prize in Chemistry for Quantum Dot Discovery not only recognizes a remarkable achievement but also heralds the dawn of a new era in science and technology. The steps taken by these visionary scientists, from the initial quest for the nanoscale world to the precision engineering of quantum dots, have illuminated our understanding of materials and opened up a universe of possibilities. Quantum dots are poised to reshape industries and make the world a better place through their myriad applications. This Nobel Prize stands as a testament to the power of human curiosity and innovation in driving progress and shaping the future.

Author:

Amro Heikal FIScT CSci - Amro Heikal has more than 27 years of experience working in the Oil and Gas industry for such companies as Halliburton,



Schlumberger and Baker Hughes. He has worked in most Middle East countries, the United Kingdom, all North Africa, and Azerbaijan, focusing on new technology developments that reduce pollution and optimize operation. Amro was awarded an IST Fellowship in 2021 and gained Chartered Scientist in the same year.



Revolutionizing the treatment of disease: An introduction to Advanced Therapy Medicinal Products

Dr Tim Sandle CBiol, FIScT

Introduction

Advanced Therapy Medicinal Products (ATMPs) are gene therapy medicinal products, somatic cell therapy medicinal products and tissue engineered products (1). These therapies, without hyperbole, offer groundbreaking new opportunities for the treatment of diseases and injuries. They are particularly important for severe, untreatable or chronic diseases for which conventional approaches have proven to be inadequate (2). There is, in addition, a specific category for those products that consist in an ATMP combined with a medical device (combination products). In terms of pharmaceuticals, they are classed as biologics.

Human cell-based medicinal products are heterogeneous with regard to the origin and type of the cells and to the complexity of the product. Cells may be self-renewing stem cells, more committed progenitor cells or terminally differentiated cells exerting a specific defined physiological function (3). Cells may be of autologous (originated from the same patient) or allogeneic (from a person other than the patient) origin. In addition, the cells may also be genetically modified. While cells may be used alone, associated with biomolecules or other chemical substances what is of relevance to this article are where cells are combined with structural materials that alone might be classified as medical devices (that is combined advanced therapy medicinal products).

What are ATMPs?

ATMPs are medicinal products containinh viable cells or tissues, and where the pharmacological, immunological, or metabolic action of those cells or tissues is considered as the principal mode of action of the product, These are different to traditional transplants, where cells or tissues are not considered to be 'substantially manipulated' outside the body and are used for the same essential function in the donor and the patient. In contrast, with ATMPs the cells have been 'substantially manipulated'. Manipulated during manufacturing process means that the biological characteristics, physiological functions or structural properties have been modified to be relevant for their intended function.

For the purposes of this article, ATMP products are taken to represent (4):

(A) A gene therapy medicinal product. These are:

- Products containing an active substance which contains or consists of a recombinant nucleic acid.
- A product used in or administered to human beings with a view to regulating, repairing, replacing, adding, or deleting a genetic sequence.
- A product where the therapeutic, prophylactic, or diagnostic effect relates directly to the recombinant nucleic acid sequence it contains, or to the product of genetic expression of this sequence.

(B) A somatic cell therapy medicinal product (the clinical application of somatic cell therapies and tissue-engineered products is frequently referred to as regenerative medicine). These include products presented for use in or administered to human beings with a view to treating, preventing or diagnosing a disease through the pharmacological, immunological or metabolic action of its cells or tissue.

(C) A tissue engineered product, where the cells or tissues are not intended to be used for the same essential function or functions in the recipient as in the donor (5).

In terms of what makes the above products 'advanced':

• It must incorporate, as an integral part of the product, one or more medical devices

- Its cellular or tissue part must contain viable cells or tissues, or
- Its cellular or tissue part containing non-viable cells or tissues must be liable to act upon the human body with action that can be considered as primary to that of the devices referred to.

Although novel, appropriate controls are required to protect patients, especially from undesired immunological responses in the recipient that could compromise the therapeutic activity.

The first ATMP

The first ATMP product approved in the European Union (EU) was in 2009 with the authorization of ChondroCelect®, a tissue-engineered product indicated for the treatment of cartilage defects. During osteoarthritis degenerative processes, major modifications of articular cartilage are observed at the tissue, cellular and molecular levels. Articular cartilage, if damaged, may lead to the subsequent development of osteoarthritis lesions, which is of major public health concern. Pharmacological treatments and tissue engineering are combined towards regenerative medicine to induce cartilage repair.

In the United States, the first approved ATMP came out one year later with PROVENGE®, a somatic cell therapy for the treatment of some prostate cancers. The first authorized gene therapy was launched in 2012, when Glybera® achieved marketing authorization in EU. This product is for the treatment for adults diagnosed with familial lipoprotein lipase deficiency confirmed by genetic testing and suffering from severe or multiple pancreatitis attacks despite dietary fat restrictions. This was followed by MukoCell[®], which provides a new treatment option for urethral repair that uses the patient's own cells as a transplant. The replacement tissue is cultured from the patient's own cells, incorporated into the surrounding tissue within a short amount of time and develops into new, fully functional urethral tissue.

Today, examples of ATMP products include (6):

- In vivo gene therapy: mRNA.
- *In vivo* gene therapy: non-viral vector (e.g. naked DNA).
- In vivo gene therapy: viral vectors.
- Ex-vivo: genetically modified cells.

Costs and ethics

One barrier to the development of ATMPs is their development costs. In many cases, development

expenditure exceeds \$1 million per patient. Hence, the development requires high up-front funding, which serves to make ATMPs particularly problematic in terms of meeting thresholds of cost-effectiveness and for the products to be affordable to the healthcare system.

ATMPs also raise bioethical concerns. This is in relation to clinical research on genetic diseases, which in itself raises scientific and ethical concerns. This means strict ethical procedures must be in place for genetic research, collection, storage and access to genetic materials, aims of the use of genetic information, the definition of the time of archiving genetic material in biobanks, informed consent and confidentiality issues. Relevant ethical questions are:

- What criteria should be met before proving that an experimental therapy is safe enough and ethical enough to begin investigating in humans?
- Is the scientific review process sufficient? What constitutes adequate oversight of gene therapy trials?
- Are protocol guidelines in the best interest of research study participants?
- Who decides which traits are normal and which constitute a disability or disorder?
- Will the high costs of gene therapy make it available only to the wealthy?
- Could the widespread use of gene therapy make society less accepting of people who are different?

Ethical considerations extend to autologous material since the question of 'ownership' of the end-product arises, in terms of whether the developer or the patient are the should have the rights for the intellectual property of the product.

Risk and the development process

Central to the development of ATMPs is the assessment of risk (7). The risk posed by the administration of a cell-based medicinal product is highly dependent on the origin of the cells, the manufacturing process, the non-cellular components and on the specific therapeutic use. The variety of cellbased medicinal products can lead to very different levels of risks for the patients, the medical personnel or the general population. The following should be evaluated:

- Origin (autologous-allogeneic);
- Ability to proliferate and/or differentiate;
- Ability to initiate an immune response (as target or effector);

- Level of cell manipulation (*in vitro/ex vivo* expansion/activation/ differentiation /genetic manipulation/ cryo-conservation);
- Mode of administration (e.g. *ex vivo* perfusion, local or systemic surgery);
- Duration of exposure or culture (short to permanent) or life span of cell;
- Combination product (cells and bioactive molecules or structural materials);
- Availability of clinical data on or experience with similar products.

Development must also account for the biocompatibility of non-cellular components. To establish this, studies should be carried out to verify critical aspects of the character and performance of biomaterials and other noncellular components used in the ATMP. The required level of assurance can be provided by assessing:

- The absence of components or leachables that might be toxic to cell growth and/or to the intended performance;
- The characterisation of features (e.g. topography, surface chemistry, strength) critical to structural support, optimisation of viability and cellular growth or other functional characteristics;
- Biocompatibility of the structural material with the cells or tissues to confirm that the system maintains the desired cell differentiation, functionality and genotype during production and until use;
- Release kinetics and/or rate of degradation of any bioactive molecules, to verify that they are appropriate for the achievement of the intended effect.

To establish biocompatibility, it is always necessary to specify the nature of biological responses that a biomaterial is required to elicit from the host tissue or cell-based components, and to provide evidence that the desired tissue response is achieved by using a relevant model.

Clinical trials are an important part of the development and licensing process. Due to specific biologic characteristics of the products, alternative approaches to Phase I to Phase III clinical trials may be required for clinical development (8).

Manufacturing

When manufacturing ATMPs, it is important that cells used in the process have been assessed for viability and the integrity of the cellular component is most critical for the product and this must be assessed by the ability of cells to survive, and maintain the genotype or phenotype needed for the intended functions. Some specific manufacturing considerations include:

- The procedure to obtain the cells from the organ/tissue needs to account for the type of enzyme, media, etc. and validated. Consideration should be given to the degree of disruption applied to the tissue in order to preserve the intended functional integrity of the cellular preparation and to minimize cell-derived impurities in the product (cell debris, cross contamination with other cell types).
- Procedures used to isolate and / or purify the cell population of interest should be described. The effectiveness should be addressed in relation to the intended use and the method(s) must be validated.
- With cell culture, during in vitro cell culture, consideration should be given to ensure acceptable growth and manipulation of the isolated cells. The processing steps should be properly designed to preserve the integrity and control the function of the cells. The procedures for any manipulation should be documented in detail and closely monitored according to specific process controls. The duration of cell culture and maximum number of cell passages should be clearly specified and validated. The relevant genotypic and phenotypic characteristics of the primary cell cultures, of the established cell lines and the derived cell clones should be defined and their stability with respect to culture longevity determined. When addressing the phenotype of the cells, relevant markers can be used (for example, with cellular components of allogeneic origin, identity should include histocompatibility markers). These markers may be based on gene expression, antigen presentation, biochemical activity, response to exogenous stimuli, capability to produce biologically active or otherwise measurable molecules, and so on. For adherent cells, morphological analysis may be a useful tool in conjunction with other tests. Where applicable, a description of the procedures which could lead to a modification of the characteristic of the product, including adhesion, absorption, degradation, presentation of components of the culture media, should be provided. With genotypic aspects, this may need to include the dentification of genetic polymorphisms.
- The consistency and repeatability of the cell culture process should be demonstrated and the culture conditions including the media and the duration should be optimized with respect to the intended clinical function of the cells.
- Various treatments (physical, chemical or genetic) can be applied to cells. The method used to modify the cells needs to be fully described and scientifically justified.

 Where cells are grown directly inside or on a matrix/device/scaffold, the quality of the combined advanced therapy medicinal product relies predominantly on the properly controlled manufacturing process. To achieve this, the cell culture process has to be thoroughly validated and the effect of the device on the cell growth, function and integrity has to be taken into account. The effect that the cells may exert on the device (such as with understanding the rate of degradation) should also be considered.

In-process controls are important during manufacturing, particularly in relation to in-process controls at the level of critical steps or intermediate products.

Quality control and batch release

Due to the life-expectancy of the product (in that the product may need to be administered immediately after manufacture to the patient), it may not be possible to perform the release tests on the active substance or the finished product. Where this is the case, the following should be considered and take on a level of importance:

- Having an adequate control strategy for the testing of key intermediates (instead of the finished product) or in-process controls (instead of batch release testing) where the relevance of the results from these tests to the critical quality attributes of the finished product can be demonstrated.
- The use of real time testing in case of short shelflife materials/products.
- Increased reliance on process validation, such as additional assays, including potency testing or proliferation assays.
- It may be justified to waive the on-going stability program for products with shorter shelf-life. However, where possible stability studies should be enacted (as discussed below).

Where testing in advance is possible, this should include the sterility test (9). There will also be challenges in developing analytical methods for novel products (10), especially with the standard criteria of product quality, such as "identity," "purity," "potency," or "mechanism of action," which may be more difficult to establish. A key quality attribute will be the potency, as assessed using a suitable potency assay (potency is the quantitative measure of biological activity based on the attribute of the product, which is linked to the relevant biological properties). The selected assay to demonstrate the biological activity should be based on the intended biological effect which, in turn, are related to the clinical response. The potency assay should be performed by using a specified number of cells and, when possible, quantified against a qualified reference preparation. The potency should be defined as the required time to obtain a predefined effect (e.g. restoration of function or repair of anatomical structure) or the potency is calculated from the measured effect in a defined time period. This can be by:

- In vitro assays using cell systems or,
- In vivo assays using animal models.

Major cellular functions as viability, self-renewal, death and differentiation are pivotal to the quality, function and sustainability of the product may need to be monitored during production and at release using surrogate markers and appropriate technology (such as making use of gene expression profiles by microarrays, flow cytometric immunofluorescent analysis, cell cloning, PCR and many others). In vivo assays for potency may also be useful especially when experimental animal models are available, and it could be that a combination of multiple methods will be needed to adequately define the potency of these products during the development. Certain assays may be needed to control process changes, whereas others are more suitable for release testing.

Important criteria for batch release relates to the characterization of the finished product. The cellular component will need to be assessed in terms of identity, purity, potency, viability and suitability for the intended use. The expected biological function of the ATMP encompasses complex interactions that may range from a biochemical, metabolic or immunological action. At the same time as assessing purity, an examination of impurities also needs to be conducted. This is particularly important where stem cells are used since there is a concern regarding the tumorigenicity of these products in humans, mainly due to the possible unintended contamination of undifferentiated cells or transformed cells(11).

Summary

These is, with good reason, considerable interest with advanced therapy medicinal products (ATMPs), products that include gene therapies, somatic cell therapies and tissue-engineered products. This is because such products have the potential for major transformative improvements in health outcomes for a wide range of diseases, including certain cancers, muscular dystrophy, neurodegenerative (like Alzheimer's and Parkinson's diseases), and cardiovascular diseases. However, since ATMPs are part of an emerging field the risks remain variable, particularly due to the starting materials. Risk will decrease as the science advances and where there is an increase in the knowledge of the various products.

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Advancing Technical Excellence: The NTDC/HEaTED Commitment to Higher Education Technicians

National Technician Development Centre (NTDC)

<u>HEaTED</u> is a leading organisation for Higher Education and Technician Educational Development, providing opportunities for the technical workforce to engage with CPD and training, as well as delivering networking events for all specialties. We provide opportunities for career development, training, and foster professional networks across various specialisations. As the training arm of the National Technician Development Centre (NTDC), we have been partnered with the Institute of Science & Technology (IST) since our inception.

In the autumn of 2023, the team celebrated an exciting announcement as the NTDC and HEaTED strengthened their longstanding partnership with IST. This collaboration has brought forth two leadership programmes designed specifically for technical staff. To learn more about these new initiatives, we invite you to hear from Sam Hansford, HEaTED's Operations and Engagement Manager:

"With over 22 years of experience as a Higher Education Technician, I am delighted to have joined HEaTED, the training arm of the NTDC here in Sheffield. My tenure with this team, although brief, has already witnessed the successful launch of our two pioneering technical leadership programs. The Institute of Science & Technology (IST) has been a staunch supporter of our <u>Technical Leaders</u> <u>Programme</u> and <u>Stepping into Technical Leadership</u> <u>Programme</u>, which have commenced their first cohorts for the academic year 2023/2024.

Technicians are in a unique position in HE institutions; they must translate the academic vision into reality utilising whatever means are at their disposal. They work independently, reactively and proactively in STEM, arts, dance, theatre and architecture focused environments. Technicians can also lead colleagues, students, peers and of course, other technicians to achieve their goals. HEaTED upskills technical staff with the technicianfocussed CPD courses that we deliver. Our new leadership programmes provide valuable insight into effective leadership, team management and strategic decision making.

Delegates with leadership experience explore how to lead through complex change, and understand their own leadership style, its impact, and how to clearly communicate to others. They will understand the change process and how to manage it on a stakeholder, cultural, and personal level. They will understand how to engage with the 'change agenda', how to drive engagement and how to further develop it. They will learn how to influence and bring others with them using negotiation skills, emotional intelligence and by enhancing team performance. They will learn how to develop creative problem solving by reflecting on team capabilities and individuals.

For Technicians moving into leadership roles, they will learn how to transition from being a team member to team leader via engaging online workshops. They will look at the mindset changes needed to go from 'doing' to 'leading', with identified expectations of themselves and others. They will learn how to have courageous conversations with a positive outcome. They will look at mental stress and wellbeing, a priority consideration in a post-pandemic workforce. They will learn how to manage change and how, as a new leader, they can impact positively on the change process.

HEaTED puts Technicians first and we aim to be as flexible as possible with course delivery. With this in mind, we have now launched a second cohort for the '<u>Stepping into Technical Leadership Programme</u>' which will run from February to June 2024. Payment is also flexible with the option of CPD credits, online payment, or purchase order. So please get in touch to be added to our waiting list for this course atl <u>enquiries@heated.ac.uk</u>." HEaTED continues to empower higher education technicians through our dedicated focus on professional development and career advancement. Our Operations and Engagement Manager exemplifies this commitment as she transitioned from a career as a Higher Education Technician to becoming a part of the HEaTED and NTDC team. Sam's journey reflects a dedication to elevating the roles of technicians in higher education, enhanced by her diverse experiences as a HE technician herself.

Other HEaTED & NTDC Services and Opportunities

We are pleased to inform you of the ongoing efforts by the NTDC and HEaTED to enhance and adapt our services to better serve our partners and members. As part of our commitment to the career development of technicians, HEaTED is now offering members one-onone sessions for <u>CV Analysis and Personal Statement</u> <u>Reviews</u>, with a dedicated HEaTED facilitator. We have also launched two new half-day CPD courses: <u>Positive</u> <u>Influencing Skills</u>and <u>Career Development for</u> <u>Technical Staff</u> which will be delivered in 2024.

In addition, the NTDC is actively supporting technical outreach projects through the <u>Technician</u> <u>Development Fund</u>. This initiative welcomes applications from Partner Affiliate Member technicians to access up to £500 in funding for projects aimed at promoting technical careers to underrepresented groups and young people. This opportunity is closing on 26th January 2024.

Our dedication to providing valuable resources extends to hosting <u>free events for our members</u>. These events cover a wide array of topics, including diversity in technical services, career development, technical outreach and apprenticeship support.

The <u>NTDC Technician Photo Competition</u> is on the horizon, set to open in January 2024. We eagerly anticipate the entries that this year will bring and the stories they will tell of technical teams across the network. Furthermore, universities across the UK continue to participate in the <u>NTDC Technician Survey</u>. This survey serves as a vital tool in gaining insights into technical skills, skills gaps, and the career aspirations of technicians within educational institutions.

Useful Links:

HEaTED website - <u>www.HEaTED.org.uk</u>

NTDC website - www.NTDC.ac.uk

We are committed to providing technical staff with the support and resources needed to thrive in your roles as technicians. As we move forward, our aim is to continue improving and adapting our services to better meet the needs of technical staff across the NTDC and HEaTED network.



TECHNICAL LEADERSHIP PROGRAMMES

FOR EXISTING TECHNICAL LEADERS & ASPIRING TECHNICAL LEADERS



Is Demographic detection AI unsustainable in its current form?

Beckett LeClair MIScT

A website believes you to be female based on usage pattern analysis, and tailors the advertisements served accordingly. A CCTV camera records footage of you travelling to work, guesses your demographics based on your face, and passes this information on to law enforcement. A well-meaning insurance company scans your application to guess your characteristics and monitor for service bias. These are just a few potential uses for AI-based demographic detection. Indeed, some are already familiar to us, with others only on the horizon. Many have already discussed the wealth of ethical, legal and social implications around the use of this technology, so that will not be covered here. Instead, let us consider a different angle – just how sustainable is it?

I recently co-authored a report for the CDEI where this was one question we sought to answer. One finding was that demographic trends are leading towards new and otherwise-unseen categories requiring creation, as well as blurring lines between demographic categories (increasing likelihood for inaccuracies). Shifting demographic landscapes could offer diminishing accuracy returns for pre-trained models, carrying implications not only for end users but also the wider stakeholder community, including investors. We are likely to see increased investment payback time, and a higher total cost of misclassifications (where such costs exist). Let us consider some examples.

First imagine an algorithm that looks at someone's name and face and infers ethnicity. If the highestweighted element is the surname, we may expect issues. A surname that might have been identified strongly with a particular ethnic background decades ago may be less indicative today, due to increased multiculturalism. For how long will our model continue to be viable? An increasing amount of people are also identifying themselves as having a 'mixed' ethnicity. Does our algorithm account for this? What does it think 'mixed' looks like, considering the wider variety of phenotypes we could expect this to take in the real world? How do we even approach handling of mixed ethnicities, when the implications for end use (e.g. bias monitoring) may vary depending on just what backgrounds comprise each mix? People identifying as having mixed ethnic backgrounds are not a uniform monolith and should not be lumped together as such in the data. The notion of what the 'average' member of each ethnic background looks like will shift in any case, presenting more problems for our model.

Next consider an algorithm that looks at a face and infers gender. This model may have learned to associate makeup as being a purely female trait when trained on historical data. However, fashion trends (particularly among younger generations) are now more open to men wearing heavier makeup, with some products advertising to men specifically. Our model will struggle to identify men wearing makeup correctly. A more impactful issue may present itself if we use the model to monitor for service bias against transgender individuals, who are a protected group in some jurisdictions. Disparate access to medical transition, among numerous other factors, means that our model will likely fail to accurately identify the demographic it is attempting to monitor bias for a significant portion of the time, defeating its deployment purpose. Now imagine this model is presented with a non-binary person, as increasing numbers of people identify as such. It does not have a category for this, nor data of the 'average nonbinary face' to learn from. The misclassification problem compounds.

There are clear challenges with changing demographics, particularly when it comes to training models to recognise categories which by nature blur the traditional societal expectations for categorisation. It comes down to internalised notions of identity in many cases, which cannot be easily determined by glance.

One workaround which researchers have already proposed is the use of models which learn continuously, instead of being trained once. This, however, does not help where we must create new categories where we don't already have some data to train with. Additionally, these continuously-learning models are much harder to approve for use where contexts are sensitive, as they open up for more risks of things such as data poisoning or fluctuating accuracy. On the other hand, one could argue that ongoing learning helps prevent bias creep towards outdated data trends. This is likely to be important to image data, where we would need to take shifting fashion trends and other cultural norms into consideration. Men in antiquity commonly wore what we might consider skirts today, though this only tends to be practiced by a much smaller group of men in Western society today. This may change again in the coming decades, if red-carpet stars like Billy Porter and Harry Styles are any indication!

But will introducing new categories for new identities result in the development of new biases against those identities? Especially considering current social attitudes and extreme politics, this is a genuine risk. One alternative would be to simply abandon using the technology for this purpose altogether. This is something that has already been covered extensively by other authors, with a deeper look at the ethical question marks that demographic detection raises. Indeed, in some areas of the world, this is likely to become the case. Under the EU AI Act, both biometric identification/categorisation and facial recognition databases are (currently) considered 'unacceptable' risks, ruling out many of the methods we might expect to otherwise be employed. I am wary of the large potential for misuse of such AI systems in the first place (despite many use cases claiming otherwise benign intentions); in the end, accepting that demographic detection is too much of a socio-legal minefield to be considered trustworthy or even worthwhile at all may be the only watertight solution. I am also aware that this is just one of many viewpoints, however. Perhaps there is an alternative way forward using co-ordinated industry expertise to fill the 'governance vacuum', for example by taking inspiration from drug trials and introducing a 'prelicensing' phase where the acceptable (and unacceptable) use cases are agreed upon. A regulatory sandbox may also be worthwhile to trial ideas in a managed space. No matter what, it would be wise to continuously monitor and assess performance of any solutions that make it 'into the wild', to ensure they perform as expected.

Only one thing remains immutable – for developers and end users, the question of sustainability in demographic detection use cases is not going away.

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Beckett is a Senior Engineer in the Digital Assurance team at Frazer-Nash. He has experience in cyber security, safety engineering, and AI, with a



current passion for supporting responsible technology futures.

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Technical News in the UK Short Insights

Science Council Celebration of Science

Thinktank, Birmingham Science Museum hosted the Celebration of Science on Wednesday 15th November 2023 for professionals who had achieved registration awards and were recognised for their winning CPD, volunteer and apprenticeship journeys.

The event enjoyed a special keynote from Dr Becky Smethurst who is an astrophysicist, author, science communicator and Royal Astronomical Society Research Fellow at the University of Oxford.

The day was a celebration of registrants who had the opportunity to network with like-minded professionals across all different industries, and from different professional bodies.

Our membership is made of technical professionals who become registered and provide exceptional skills in their sectors. IST members were amongst many of the winners at the event.

Congratulations to all award winners

Congratulations to the following members who won the CPD Awards celebrating their outstanding professional development in science:

- Abigail Mortimer, RSciTech
- Rae Freestone, RSci
- Dr James Fox, CSci

The event also had a category to celebrate outstanding contribution to science, very well done to those individuals including:

- Dr James Fox, CSci
- Laurence Dawkins-Hall, CSci
- Stephen Franey MBE, CSci
- Late Valerie Gordon, RSci

The event also celebrated apprentices and their registration journey with both RSciTech and RSci registrants receiving awards.



Abigail Mortimer, RSciTech Role: Scientific Glassblower Organisation: University of York



Rae Freestone, RSci Role: Lead Laboratory Technician Organisation: Cambridge Consultants



Dr James Fox, CSci Role: Deputy Operations Manager Organisation: University of York

Workforce Skills Conference



In 2023, the Institute of Physics hosted the Science Council Workforce Skills Conference on 19th October. The event had support from UK Research and Innovation (UKRI) and provided a space for discussion on key topics in relation to the scientific workforce. Members of the Science Council represented their organisations at the event.

Professor Dame Angela McLean, the UK Government Chief Scientific Adviser delivered a keynote address specifically for the event.

"A capable workforce is key to building a successful organisation, with STEM skills being crucial to creating a genuinely scientific Civil Service.

Delighted to highlight the importance of science and tech in Government at the Science Council Workforce Skills Conference last week"

> - Professor Dame Angela McLean Government Chief Scientific Adviser

The conference included panels with speakers from organisations such as UKRI, the National Centre for Universities and Businesses (NCUB) and the British Academy. The speakers gave valuable insight and opened discussion on key topics including AI in the STEM workforce, sustainability, supporting cross sector mobility, technical education, professional registration and the need for a multidisciplinary approach.



Professor Dame Angela McLean DBE FRS is the Government Chief Scientific Adviser having taken up the role in April 2023. She is also Head of the Government Science and Engineering Profession. Prior to this, Angela was the Chief Scientific Adviser for the Ministry of Defence.

TechxFest - Showcasting Technical Careers

TechxFest was a new careers event dedicated to inspiring the next generation of technicians, and the IST were proud to be exhibiting at the event and significantly, were one of the only exhibitors that was dedicated to offering vital information around future careers within the creative industries and technologies.

From apprenticeships in arts, exciting opportunities in engineering and rewarding roles in research, technical careers are for everyone.

Technicians are the backbone of the UK workforce, yet to technical roles. many people don't know about the range of technical jobs which play an important role in our world. To address this, th

Almost 600 year 9 and 10 children from the Midlands explored what their future could look like as a technician.

More than 50 UK-wide employers showcased technical careers through innovative stands and demonstrations on 28th September 2023 at Derby Arena.

The UK technical community is a highly skilled workforce with a diverse range of expertise and roles within engineering, manufacturing and the creative arts; they are a vital part of many employers' workforce.

Yet the technical profession suffers from a lack of visibility and recognition, and career opportunities are rarely promoted or well known.

Now there is a shortage in the UK of technicians across all sectors with many employers struggling to recruit to technical roles.

To address this, the TALENT programme, University of Derby, University of Nottingham, Derbyshire Festival of Business and Amanda Solloway MP joined forces to organise TechxFest 2023.



IST Technical Conference 2023 London South Bank University

Delivering Excellence and Innovation in a Changing Technical Landscape



Reflections from 2023 Conference host coordinator, Tony Roberts.

This year, London South Bank University hosted this years technical conference in September. The conference was an exciting opportunity to promote and celebrate key themes as well as recognising 75 years of the IST supporting technicians. Therefore, technicians were at the heart of the conference and made the day an absolute success.

The conference was opened with a warm welcome from the IST President Helen Sharman CMG OBE who in her opening remarks spoke about the importance of professional registration, and the work of the IST in emphasising the wider importance of technicians and recognition of the role they play in our daily lives.

LSBU's Vice Chancellor Professor David Phoenix OBE

similarly welcomed all delegates and whilst reflecting on the need to address the issues around technician visibility, noted the ideal timing of the conference with such wide interest in the need for technical skills.

In the morning keynote address, Dr Kelly Vere MBE spoke about her journey as a technician, including the challenges that so many technicians have felt in trying to navigate through the complexities of higher education and it was equally as inspiring to see how the landscape has changed as a result of the technician commitment and MI Talent. It was also an opportunity for delegates to hear more about several key initiatives, including the very recently launched Institute for Technical Skills and Strategy – as the 'new home' for the technician commitment.



There was a full and varied programme of workshops throughout the day with talks and presentations under the themes of Career Development Pathways, Artificial Intelligence, Arts and the Creative Industries, Digital and Media, Health & Safety and Environment and Sustainability.

These along with the interactive tours were delivered by over 40 volunteers from the technical community and was very well received by the 320+ delegates.

Photo insights from the day



Awards to Fellowship



Murray McMonies, FIScT CSci



Alicia Colson, FIScT



John Amaechi OBE, FIScT CSci



Unfortunately David was unable to attend the event to receive his award, and it was presented at a later date.

David Smart, FIScT

Awards to Fellowship of the IST were presented to Murray McMonies, Alicia Colson, John Amaechi OBE, and David Smart.

This senior class of membership indicates a very high level of achievement in the field and an outstanding contribution to the profession. Fellowship candidates have considerable experience gained over a number of years of responsible work and are able to demonstrate important achievements relating to the application of science, technology and/or management skills.

Fellows of the Institute are elected by the IST Executive on the recommendation of a Fellowship Panel which comprises at least 3 Fellows of the Institute in good standing. The Fellowship Panel take into consideration, in support of each application, qualifications, professional work experience, and contribution to the advancement of science and/or technology.

Fellows contribute in some way to the activities and/or development of the IST and/or the UK technical workforce and the nature and extent of that potential contribution are taken into account when Fellowship applications are assessed and renewals reviewed. Contributions can include the submission of Journal articles, support for professional registration, enhancement of the IST profile in the workplace – to name just a few examples.



2023 Image Competition Winners

The IST image competition invited technicians to submit photography related to their disciplines, the theme for the 2023 competition was 'Technical excellence & innovation'. This attracted 42 excellent entries covering many technical disciplines. Third, second and first places prizes were awarded for images depicting Crime Scene Processing and Management by Laura Elsey, Infection and the Importance of PPE by Ameila Stubbs and Instrument measurement preparation in an RF Anechoic Chamber by Peter McKenna.



1st Place Winner

Peter McKenna University of Glasgow

Assisting PhD student mount antenna for measurement in the RF Anechoic Chamber.

2nd Place Winner

Amelia Stubbs University of Surrey

Two teaching technicians, Chloe Tait and Amelia Stubbs demonstrating infection control precautions and the importance of PPE in a simulated viral disease outbreak, which is typically carried out by veterinary students, with the use of UV spray to mimic airborne microbes. As teaching technicians, we simulate the practical contents to ensure sessions are delivered to the highest standard, using innovative concepts to create realistic scenarios which students may come across within their careers.





3rd Place Winner

Laura Elsey London South Bank University

A Crime Scene Processing and Management Assessment produced for the students. Many thanks to our Conference Key Sponsors and Exhibitors

2023 CONFERENCE KEY SPONSORS



2023 CONFERENCE EXHIBITORS



2023 CAREER ZONE SUPPORTERS



Photo insights from the day

The conference incorporated an industry exhibition with four key sponsors, 16 industry exhibitors and wide support from key networking groups and organisations, all of which gave delegates the opportunity to network with their peers, whilst learning and exploring sector and technology innovations.



2023 Conference Feedback

Keynote 1: Dr Kelly Vere MBE - Transforming the Technical Profession: Shifting Narratives & Building a Positive Culture

Very engaging topic and really highlights the difference we make, from someone who has made it their life's work! Inspirational.

Keynote 2: Professor David Phoenix OBE - Post 16 Technical education and the need for sector differentiation FE - HE technical universities

Inspiring as to how he's helping the area, the youth and the more mature students achieve something by making it a better fit than the standard pathway to HE from FE.

Workshops:

Great to hear this has been set up and it seems very simple to use. All speakers very enthusiastic and informative. Interesting, relevant and can be applied in my workplace.

A great inclusive supportive talk, no feeling of us & them.

Interactive Tours:

Wow, blown away by clinical simulation. Never knew how interesting and varied the role was. The tour leaders enthusiasm for passing on her knowledge to her students was self evident. A most excellent demonstration.

Yes, this was brilliant and extra fun! Really engaging.

General Comments:

A thoroughly enjoyable day with wide ranging topics. It was great to hear about the progress on the creative practitioner registration and to meet fellow technicians from the creative sector.

> Good range of topics relevant to my role. It was hard to choose just one per session but my colleagues attended different topics so we will share learnings.

IST Network Groups AI, Women in Tech and Scottish

Networks are at the heart of how we as a professional body functions. Professional networks are vital in ensuring the growth of any organisation and such networks bind together people to help us achieve our goals. Networks can help individuals and their organisations realise new opportunities with an existing part of a network, or forge new relationships through recommendations and professional references. This year we established yet another new network group. Each network has specific goals in terms of providing support and routes via which members can get involved.

IST Women in Tech Group

The Women in Tech Group aim to advance the knowledge and interests of Women in Tech, support and empower females and help to overcome barriers to, or within, scientific/technical careers.

We do this through events, both professional and informative events. We look to create sub committees to advance the Women in Tech impact and vision. We like to put an emphasis on young women in tech and are working on getting more girls and women interested in STEAM.

We have exciting events planned for the year and will continue to develop a supportive community. Some of the benefits of being in the groups are:

- Talks on various subjects and themes
- A supportive community
- Women in STEAM Showcase
- Young Professionals in STEAM Showcase
- Career Talks
- Workplace Support
- Networking
- CPD Benefits

One of our projects is to gather showcase slides about women currently working in STEAM which can be used as repository of posters to supply to schools to encourage girls to consider careers in STEAM. We need as many posters as possible, and are happy to generate the posters if our women members can send the following to office@istonline.org.uk:

- Name, current role and employer
- 4 or 5 bullet points about your work role plus 2 or 3 photos
- 4 or 5 bullet points about your hobbies/leisure activities plus 2 or 3 photos

Please help with this project, and send us your information and if possible encourage your colleagues to contribute also.





IST Artificial Intelligence Group

AI Practitioners, Regulation and Ethics

There is no single source of truth when it comes to practitioners incorporating standards and ethics in the development of machine learning models or 'AI'. Multiple working groups, voluntary groups, academic institutions and industry all clamour to be the loudest voice in this area. However, current guidance from many of these places is not implementable in a reasonable way for practitioners. The world forgot that high flying ideas about ethics have to be incorporated into model design at a low level. This is where a large disconnect exists.

It is not just within this disconnect that practitioners sit. Through multiple studies many problems have been uncovered that have plagued practitioners for decades both in government and industry alike. A 2021 House of Lords Enquiry (post the <u>2012</u> <u>Macpherson Report</u>) on analytical modelling in the UK raised wide ranging issues for practitioners around lack of respect for modelling professionals, policy not being evidence based, lack of resource and lack of leadership. Similarly, in 2019 <u>Holstein *et al.*</u> found and made recommendations to address issues faced by practitioners, with a particular emphasis on gaps in legislation and regulation.

Below is a shortened list of some of the major issues found to be contributing to the unethical development of AI:

- · Lack of ability to challenge issues within a model
- Communications issues
- · Lack of resource
- Lack of business continuity planning
- Limited or no use of correct specialists
- Faulty data Collection
- Lack of model buy in by stakeholders
- Over reliance on technology and algorithms alone
- Lack of supporting paperwork, model/code documentation and explanation
- Lack of leadership
- Corruption of results
- Lack of respect for modelling professionals
- A lack of ethical training in the UK generally

In an Industry survey, the following shortcomings were highlighted:

- Lack of understanding of regulation or if it even existed
- No awareness of validation and verification processes or audit methodology
- Clear lack of fairness issues within models

- Inability to program sensible human assumptions into code
- Using PR on the back end to 'fix' any perceived issues

The situation has only worsened since 2019, and there is an increasing propensity to avoid addressing ethical issues within the model build by utilising PR to improve the cosmetic image of products in the public view. It is often cheaper to use PR rather than invest in serious ethical model building. Institutions that do this incur a huge risk toreputation and possible financial damage. Such issues have been demonstrated with facial recognition technology and the Home Office visa algorithm scandal.

Bad ethical practice can lead to disastrous consequences in the community and society at large. Government departments that examine data sets must ensure that no user is excluded from services they rely upon due to faulty data or algorithms. Training data sets that reinforce bias within models can easily exclude, and/or reinforce rules that exclude, users. The field of data collection is one rooted in statistical methodology but many projects do not consider bringing a Chartered Statistician on board as necessary. This is a critical step because a Chartered Statistician spends many years learning methodology, mathematics and theorems in order to understand how data collection and methodologies work. This is to ensure that the best, objective data collection for the required context is conducted. It can be very expensive to begin again if the data are found to be faulty post collection. A non-Statistician may not have this understanding. This is the same principle as a service user with a particular lived experience, their requirements cannot just be assumed, we have to ask the expert.

Model building has moved from basic numerical modelling to more complex models that can take in vast amounts of data and may make critical decisions about people, their lives and services,. The model is now a software product needing software specialist oversight for testing and implementation. This starts to necessitate a large modelling team with specific experts included. The extent to which this complex decision making occurs is shown within driverless cars. For example, if you want to code one specific aspect of an autonomous vehicle you should examine the trolley problem, i.e if you have a child on your left and two adults on your right, which way do you swerve to avoid the car coming at you? We not only need a lot more context to be coded (what are the weather conditions, are there any other obstacles, if we just

stop what happens, etc. etc), but we need to prioritise who dies. This might not be a palatable discussion, but it is the type of decision we make every day as humans without really realising it.

We take a lot of things for granted in the world and focus on those things more out of the ordinary. However, the part we take for granted also needs to be expressed in models, not just the event. This makes it difficult for practitioners to code complex models and unfortunately the speed with which technology has advanced has outstripped any current guidance and we are playing catch up.

This is a substantial challenge and is why the Institute of Science and Technology has launched its Professional AI Accreditation.

The Institute of Science and Technology (IST) goes a long way to filling the gap between cutting edge research and professional accreditation (upcoming) for AI practitioners. Our framework aims to support practitioners and provide a methodological centre of excellence so that we can move forward with more ethical modelling that is safe for society.

Currently the AI Group of the IST is engaged in the following activities:

- A research framework for teachers and users of AI tools. In association with London South Bank University.
- Seminars on best practices in AI
- Publishing papers on specific problem area in AI
- Supporting practitioners by accrediting their skills in ethical AI
- Building an AI Practitioner Community to bring our voices together so we can be heard and also to feed into policies and regulation
- Designing and providing training courses for professional bodies on ethical AI
- Designing and publishing best practices for AI starting with the AI Accreditation

This post draws on the author's article, <u>Technical challenges and perception: does AI have a PR issue?</u>, published in AI and Ethics.

Dr Marie Oldfield CStat, CSci, FISCT, SFHEA, is Chair of the IST AI Group, CEO of Oldfield Consultancy and senior lecturer in practice in the Department of Mathematics at LSE, her research interests are in the human centred ethical approach to designing and implementing Artificial Intelligence. This cuts across multiple disciplines such as philosophy, computer science, sociology and psychology.



AI Slack Channel Avaiable Now

Are you and IST member with an interest in AI?



IST Scottish Network Group

Edinburgh Technical Collaboration shines spotlight on importance of technician role in higher education institutions

More than 50 technicians from across Edinburgh's universities came together at Edinburgh Napier to celebrate the first-year achievements of the Edinburgh Technical Collaboration.

Established last year, the collaboration was formed between Edinburgh Napier, The University of Edinburgh, Heriot Watt University and Queen Margaret University in response to concerns that technical staff were falling between the gap of their positions having elements of both academic and professional services roles.



Throughout the last year, the collaboration has introduced mentoring and job shadowing programmes across the four HE institutions and the event recognised the impact that the programme, along with its participating colleagues, has had in helping increase the visibility of technical roles alongside supporting personal career development.

Attendees heard from a number of Edinburgh Napier staff, including a welcome from Professor Nick Antonopoulos, Deputy Vice Chancellor and Vice Principal of Research at the University, Dr Claire Garden, Head of Learning & Teaching within Edinburgh Napier's School of Applied Science, Bill Surradge and Neil Guthrie, both Technicians within the School of Applied Science alongside Lisa McMillan and Jo Brown, Institutional Administrators, Laboratory Efficiency Assessment Framework (LEAF).

They were also encouraged to share their career stories through the Squiggly Career Stories and Me in 3 profiles before taking in a tour of the University's

Simulation and Clinical Skills Centre – Edinburgh Napier's purpose-built facility for health simulation and clinical skills training.

Tours of the University's Sport and Exercise, Animal & Plant Sciences, Biomedical Sciences, Microbiology and Psychology facilities were also offered as part of the event. Future tours of Merchiston, which includes various areas including the design workshops, music rehearsal rooms, materials centre, fabrication lab and more are also planned.

Professor Nick Antonopoulos, Deputy Vice Chancellor and Vice Principal of Research at Edinburgh Napier said: "I was really delighted to welcome so many technicians to Edinburgh Napier. It was great to hear so many positive outcomes from the collaboration that has happened across the last year.

"I think collaboration between technicians has an extra key element which is important. Collaboration is essential in terms of creating the requisite support and resilience that we need across all teams to be able to deliver in very challenging times."

"I absolutely agree that all four universities can and should strive to do better in terms of increasing the visibility of technical staff, alongside increasing the strategies for recognition and advancement of staff and that is certainly something we can help open dialogue on. I'd be very keen to look for opportunities to expand the Edinburgh Technical Collaboration to include teams like research and innovation offices."

"It's been a very successful first year and I look forward to seeing it develop further in the next 12 months."

Russell Wilson MIScT, RSci - Scotland Network Coordinator presented on the event day chairing a session in which technicians shared their personal experiences of a job shadowing and mentoring scheme. Russell then discussed the future for the ETC group & highlighted the IST Scottish support network, the creation of the steering group and flagged that further input from the technical community will be sought.

IST Member News

Celebrating our members success

CPD Award Winners



Abigail Mortimer, RSciTech Scientific Glassblower, University of York

What is it like being a CPD Award Winner?

It was great to receive the email to say I had won this award. I used to think of CPD as a specific event that I attended , like a training course or a conference, but I've realised that many things I do as part of my job can count as CPD too.

Rae Freestone, RSci Lead Laboratory Technician, Cambridge Consultants

What is it like being a CPD Award Winner?

I am humbled to be announced the winner of the Registered Scientist category this year and for the 2nd year running. I am proud to be part of the scientific community where we all strive together to make the world a better place through our hard work and learning new skills.





Dr James Fox, CSci Deputy Operations Manager, University of York

What is it like being a CPD Award Winner?

I am grateful to be acknowledged as a Science Council outstanding volunteer. I enjoy the networking and skills I use and develop through my involvement; the experience contributes both to my own personal CPD journey as well as to that of others.

Well done to Abigail, Rae and James from the Institute of Science & Technology.



Prove your value as a practising scientist with professional registration from the Science Council



RSciTech

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Registered Science Technician

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Registered Scientist

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Chartered Scientist

CSci

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not initially apply for a specific grade of membership, the grade offered by the Institute being dependent upon the qualifications and experience of the applicant.

Why Join?

To help us maintain, build and expand the (IST) community. IST can help by supporting and developing your:

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

Together we can be a voice to be heard and listened to.

Download IST Main Leaflet at *istonline.org.uk/ membership* 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 at *istonline.org.uk/membership* (Membership Application Form – docx, or Membership Application Form – pdf). 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 to memberships@istonline.org.uk or posted to our Sheffield Office.

Membership Application Notes for those applying for membership are available at 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 members card will be sent. Following entry on the Register members are entitled to the designated post-nominal letters relevant to their grade.

To continue our ongoing support for members, we are keeping our fees the same as they were back in 2022, to help assist technical staff and managers.

Membership fees are: from 01/01/2024

- Junior: £10
- Affiliate: £24
- Associate: £41
- Member: £54
- Fellow: £68

*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 one of the following forms to office@istonline.org.uk Membership Reinstatement Form (docx), or Membership Reinstatement Form (pdf) Payment of subscriptions can be via:

- direct debit
- credit/debit card/Paypal online at <u>https://istonline.org.uk/membership/</u>
- bank transfer (please contact office@istonline.org. uk for bank account details)
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NB: All applications are subject to review; the IST reserves the right to decline any membership application.

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