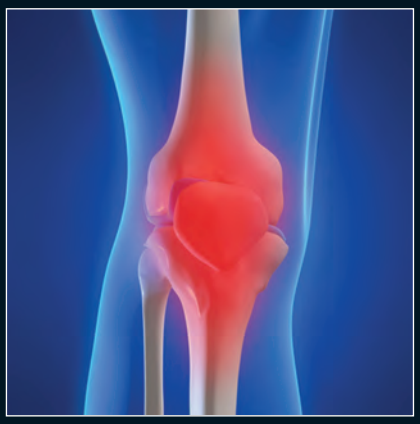
The Institute of Science & Technology

The Journal

Summer 2009



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The Professional Body for Specialist, Technical and Managerial Staff
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The **Journal**

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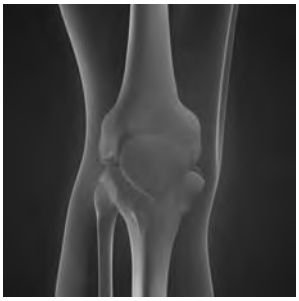
CONTENTS – SUMMER 2009

Editorial

THANK YOU to Ian Gray

Well this is my very first editorial comment and firstly I want to start by saying, on behalf of all who work and support the IST, a heartfelt thank you to Ian Gray our outgoing editor. Ian had been editor for a remarkable 22 years and in all this time I believe that our high quality journal truly reflected Ian's outstanding enthusiasm and commitment. His term in office has been a terrific contribution to the IST cause and one that we should not underestimate. For me he has been an inspiration and I do feel somewhat daunted at the prospect of continuing in his footsteps. He is an impossible act to follow of course, and if you can forgive my football analogy, just like Sir Alex Ferguson's term in office Ian's is unlikely ever to be equalled.

The IST owes Ian a great deal, much more than a few words can express. Again, thank you Ian.

Ian introduced as a member of Council in the November 1977 IST Bulletin

Welcome

This bumper summer Journal has articles and papers from quite a varied subject base, so I'm hopeful that you will find something of interest.

For example you will find two very interesting and different articles in this edition, by Kevin Fletcher and Steve Gamble, which embrace evolution theories. When I read them they led me firstly to think about how much the Journal itself had moved forward and evolved under Ian Gray's stewardship, and then as my mind began to wander, I began to consider human evolution and in particular it's link with science and technology. Today technology itself seems to me to evolve at a tremendous rate, and appears to continue to do so in a somewhat exponential fashion in what is, in relation to our existence, a relatively short space of time, just a few thousand years. This then can't be contributing to our gradual evolution in Darwinian terms, or can it? There again perhaps science and technology is the catalyst for a human evolutionary leap, be it for advancement or even our demise.

But what about today, has technology helped us evolve physically for example? Well in a way perhaps, as we now live longer and healthier, but I don't think that we have really changed that much outwardly. *(Except I guess for our children's remarkable gaming thumb to eye coordination and their ability to move the said appendages at alarming speeds!)* However, could we have perhaps changed inwardly as our minds seem to be faced with ever increasing mental challenges brought about by never ending advances in technology?

We obviously accept that today electronic and information technology is part of our everyday lives but it appears that some people now fear that it is beginning to segregate us. For example Government has said that it is now very concerned about "digital exclusion". To such an extent that we now have a minister for "digital inclusion", Paul Murphy*, who is also Secretary of State for Wales. The worry seems to be that large sections of our community are not so much disadvantaged by the lack of access to, and the understanding of, today's technology but that they are not advantaged by it. Does this subtle difference begin to stack up with an evolution theory? Interestingly, for example we are told that there are around 17 million people in the UK today who are at the moment excluded from access to the internet, and there are currently many products that have interfaces which are unsuitable for people with disabilities or for that matter people outside the "consumer core" age bracket.

After all if it is "having an advantage" that increases our chance of success and therefore eventually our dominance then should we be worried about the makeup of our future human population?

On a lighter note my son keeps reminding me that my brain could do with a little more memory retention these days! So I found it interesting to read recently that researchers at HP labs have announced that they have found what they believe to be the "missing link". They claim to have discovered a fourth basic element in integrated circuits. The memristor, which is short for memory resistor, and this they hope will enable far more energy efficient computing systems, which will have memories that can retain information even when there is no power. The researchers believe that these systems could well have the same complex pattern matching abilities of the human brain. Scary!

Ian Moulson
Editor

**Just as the Journal went to print at the beginning of June Gordon Brown reshuffled his cabinet and Paul Murphy was replaced by Peter Hain as Secretary of State for Wales.*

Fred Grover

I was saddened to hear of the recent death of Fred Grover, who I have known for a number of years.

I first met Fred way back in 1974. I went for interview at the Medical Research Council's (then) recently formed Division of Psychiatry at the Clinical Research Centre (CRC) in Harrow. Whilst waiting for other members of the interview panel we chatted and found we had a mutual interest in railways. Fred was the Head Technician of the Division. I must have made a reasonable impression as I was soon hired!

Fred joined the Division of Psychiatry when it formed, under the direction of Dr Tim Crow, early in 1974. Prior to that he had been Head Technician of Dr Tony Alison's Division of Cell Biology, also at the CRC. I remember Fred telling me that his association with the CRC could be traced back to when "the CRC was just me and the old man in a shed at the bottom of NIMR's field". (NIMR being the National Institute of Medical Research at Mill Hill and 'the old man' being Dr Graham (later, Sir Graham) Bull.)

It was through Fred that I first became aware of the IST. I was soon to become the fourth IST member amongst the eight technical staff in the Division of Psychiatry. Around the time I joined the Division Fred had become interested in sailing and was building his own dinghy. He took in good spirit the teasing he received about that.

About two years after I joined the CRC Fred went off to MRC Head Office to be (I think) the first full time Health and Safety Advisor for the MRC. I still saw Fred when he came on safety visits to the CRC and sometimes on my infrequent visits to MRC Head Office. During his time at MRC Head Office Fred co-authored a book on laboratory management [1].

Several years later Fred retired from the MRC, but continued working for a number of years as a private health and safety consultant. When the CRC closed the MRC relocated a number of the staff to Cambridge and Fred used to drop by to see his old colleagues when business brought him to Cambridge.

My lasting memories of Fred? Fred was always willing to bat for his team, make sure he got the best for the junior staff he looked after. He was a gentleman. As a manager he had a relaxed style, if something needed doing he would request rather than demand. If you did something wrong he didn't get angry, but explained what was wrong, why it was wrong and how to avoid it in the future.

Fred used to mention previous colleagues, places he had worked and his time in 'the mob' (when he had done National Service in the Army) with great fondness. I think that Fred's colleagues and friends will remember him with equal fondness.

Steve Gamble

REFERENCE:

[1] Grover, F and Wallace, P (1979) Laboratory Organisation and Management. Butterworths, London. ISBN 0-408-70793-3

Develop your writing skills and earn **£100!!**

We would like to actively help and encourage members and potential members who are in the early stages of their careers to develop their writing skills, and to do this we will offer a reward of £100 for first articles published in The IST Journal.

We are also asking those Fellows and senior staff with responsibility for others to encourage/sponsor, help and support early career staff to write. And as an incentive we will offer a prize of £100 to the Fellow or Member who recruits the most authors. In the event of a tie the prize will be shared.

Email office@istonline.org.uk for further details. Conditions below apply.

Articles for submission should follow the guidelines below. The prize for the most articles sponsored will be given in January 2010 and only articles written between 1st June and 31st December 2009 will be eligible. The sponsor must be named and acknowledged at the time of submission. Submission of an article will be deemed to be agreement with these terms and conditions. Members of the Executive shall not be eligible. The decision of the Executive shall be final. Articles of approved technical merit may be displayed on the HEaTED website for the benefit of the wider technical community.

Article submissions for the JOURNAL

We welcome article submissions covering all areas of science and technology, particularly from people who may wish to publish for the first time. We encourage article submissions which cover new technological advances, diverse technology and unusual aspects of technology.

Contact the editor:
i.moulson@shef.ac.uk

Or the IST office:
office@istonline.org.uk

The guidelines for article submissions to the IST Journal are as follows:

1. Article submission deadlines;
   - Summer edition is **30th April.**
   - Winter edition is **30th September.**
2. Articles should be submitted in Microsoft Word .doc format with images sent separately as JPEG files. This is our preferred option; please contact the Editor for other formats.
3. **Short articles:** these can be submitted in any length up to a maximum of 4x A4 pages including images with a font size no smaller than Pt12 (roughly 1500 words max).
4. **Major articles:** these should normally be no longer than 10x A4 pages including images with a font size no smaller than Pt12 (roughly 4000 words max). Please contact the Editor for longer submissions.
5. All accepted articles will be edited into the IST Journal's house-style.
6. All articles must be written in UK English. *(If English is not your first language, you should ask an English-speaking colleague to proofread your article.)* Articles that fail to meet basic standards of literacy may be declined by the editors.
7. Articles should be submitted as separate email file attachments. The email should clearly state "Journal Article Submission" and be sent electronically to **office@istonline.org.uk**

HEaTED – A Hot Topic

Technical Staff Education and Development Project

Michelle Jackson

These are exciting times for technical, specialist, and managerial staff (TSM) in Higher Education Institutes (HEIs). The HEaTED (Higher Education and Technicians Education and Development) project has entered a dynamic phase of its development.

The HEaTED project aims:

- To assess the need for, and role of a representative body for the sector
- To identify the TSM training and development needs across the sector
- To fill the gap in the provision of training courses, seminars and materials relevant to the professional needs of TSM
- To provide an infrastructure aimed at the enhancement of career opportunities for TSM
- To address the gradual loss of skills inherent in an aging workforce
- To review issues related to recruitment and retention
- To create and disseminate a practicable strategy for change

Pre-2004 programmes relating to technical staff development were supported by HESDA (Higher Education Staff Development Agency). In 2004, pending further consideration of a more permanent location, the HESDA portfolio was transferred to the LFHE (Leadership Foundation for Higher Education). In response to a perceived need in training needs and to assist in updating the training portfolio, the LFHE commissioned a scoping project. This culminated in one of the largest and most far ranging nationwide surveys into technical staff training needs in the history of UK universities –viz the HEaTED Survey. In 2006 the HEaTED Survey, involving over 44 HEIs and over 3000 TSM, provided TSM with the opportunity to raise issues related to their career prospects and training needs.

TSM highlighted the following four interrelated concerns in their responses to the 2006 HEaTED Survey

The survey provided a great deal of data and was an invaluable insight into what needed to be addressed in HEIs. In particular, it highlighted a potential demographic 'time bomb' for TSM, in relation to an aging workforce The almost universal failure to deal with succession planning means that the sector faces a huge loss of vital skills. This presents a serious and potentially damaging threat to the central business of supporting teaching and research in HEIs. To address this LFHE published a report which contained a set of recommendations. One of the main recommendations was to apply to the Higher Education Funding Council for England (HEFCE) for resources to implement the HEaTED Report's recommendations. Since then two rounds of funding have been granted to develop the project. Whilst much has been achieved, there is clearly much more yet to do.

The project team is continuing to work to accomplish the fundamental vision that has underpinned the Project since its inception.

IST is the organisation best placed to implement project aims and objectives of HEaTED.

In an exciting development for the IST, it was confirmed, in October 2007, that we would be joining in partnership with HEaTED as the professional body best placed to implement the project aims and objectives. This means we have now become the 'home' for the HEaTED project and can develop the IST into *the* representative body for TSM throughout the UK. With over 30,000 TSM within UK HEIs, the potential for the IST to expand and develop is enormous. This really is an opportunity not to be missed. As a consequence, the IST has the chance to seek new and dynamic approaches, in terms of its services and image to benefit current members from all sectors, and be in a position to attract new members who hitherto have never considered joining the institute. The potential being to create an institute that will serve as an essential resource for TSM on a national scale. The advent of HEaTED has provided this unique opportunity. What will be under the microscope in the coming months is the interface between HEaTED and the IST, and how this partnership will shape the future of technical and specialist services in the years to come.

Launch of the next TSM survey June 2009

One of the recommendations from the LFHE report was that there should be regular surveys of HEI TSM, to mirror the one run in 2006. This will allow the project to monitor changes within the sector, address any new issues as they arise and assess the success of the project in tackling these issues.

After lengthy consultation the next survey is due to be launched in June of this year. To date an unprecedented **110 institutions have signed up for the survey**. This accounts for the majority of the HEIs with the UK, and is a sign of the HEaTED project capturing the prevailing mood. If you work as a TSM within a HEI this is your opportunity to make your voice heard about your working life and career concerns. As part of this project you could make a real difference to your (and many others) future career and development. *Need I say more?* If your Institution has signed up, then you should be hearing about it soon. If not you can still take part; just keep an eye on the IST website for further information. Either way please take the time to fill in the survey (it only takes 10 minutes).

The need to establish an extensive technical/specialist skills development programme is of vital importance.

Another key recommendation from the LFHE report was the development of discipline specific skills programmes. What became very clear from the 2006 survey and what has been recognised by others in the past, (Royal Society Report 1998), is that TSM in HEIs lack relevant training and career development. Tying this in with the aging demographics of the HE technical community, confirms the need for a Technical Skills Training programme is paramount. In developing these courses all IST members can benefit, not only those in HEIs, as all courses will be available also to them (at the discounted rate where applicable).

Often training for TSM is specialised and tends to be on-the job. When this is put in the context of inadequate career development, it is not hard to see the ominous signs for HEIs.

To tackle this, the HEaTED project is launching a Skills Development Programme, based to a certain extent on the initiatives developed in previous years by HESDA. With a wealth of knowledge and skills already in existence within the sector, the programme hopes to draw upon skilled technicians from HEIs to propose and to lead training days/workshops based on their area of expertise. Already we have had contributions from a number of universities in a variety of subject areas including, Biological Science, Chemistry, Craft and Design, Electronics, Forensic Science, Gases Handling, Information Technology, Instrumentation, Laboratory Management, Mechanical Engineering, Personal Development, Quality Control/Assurance, Safety, and Vacuum Technology.

Examples of training programmes being offered

Protein Structure and Introduction to Molecular Biology Methods
University of Canterbury

Polymerase Chain Reaction
University of Strathclyde

Electron Microscopy Workshop
University of Manchester

Basic Practical Electronics
University College London

Physical Sciences Good Laboratory Practice
University of Canterbury

Research fluorescence microscopes- how they work and getting the best out of your images.
University of Manchester

High Performance Computing - Advanced MPI
University of Manchester

Practical Tungsten Inert Gas Welding
University of Sheffield

Ionising Radiation: Awareness and Risk Management
University of Leeds

As well as these, a number of commercial companies have been brought into the HEaTED Project to deliver training courses at preferential rates (e.g. LGC Standards, Belvedere Safety and Portable Appliance Safety Services). These are just a few examples of what there is on offer; please go to http://www.istonline.org.uk/TSCP/technical_skills_courses.asp for a full listing.

If you have a skill that you think would benefit other technicians and are willing to provide training, please contact me (details at the end of this article).

Train the Technical Trainer events coming soon

During the design of the Skills Development Programme it became apparent that although there are many people keen to share their knowledge and experience, the confidence and skills to deliver training programmes do not automatically follow. The HEaTED project is about to host a number of *Train the Technical Trainer* events in various locations throughout the UK (the first one is planned for June). This will provide the participants with the confidence and technique to plan and to lead training sessions.

Priority for attendance on the courses will be given to those whose Institutes have signed up for the HEaTED resources and are genuinely expressing an interest in providing a course. For the pilot event in June 2009 there will be a heavily subsidised charge which will be fully refundable for HEaTED members upon attendance. Details of further events across the UK will follow this pilot session.

Perhaps the most powerful impetus for people to apply for the course is the simple fact that the skills and experience associated with leading training is highly marketable. Because HEaTED is a national project, and courses will be thus publicised, all participants in the training agenda will have their involvement on public view. In a competitive employment world the value of this cannot be overstated. So the link between ability to train and personal career advancement is plain to see.

The Virtual Learning Environment

The Virtual Learning Environment (VLE) is an exciting initiative launched through the HEaTED project, something that may be accessed from anywhere in the world. Staff from Institutes who have signed up for the HEaTED resources (more on this later) get access to an exciting new on line VLE, with the proposal that that all IST members gain access to the resources in the future.

It has been proposed that TSM be given the opportunity to offer written materials based *on what they do in their day-to-day work,* to be published on the VLE website. The purpose of the materials will be instructional or informational: i.e. to enable the reader to carry out a task, or follow a process as they work through it or simply to learn more about a particular area. It is also hoped that some basic scientific information will be included.

In this sense, the TSM will take ownership of this resource and become the core contributors to the VLE - the HEaTED Resource Centre. All contributors, whether individuals or groups, get full recognition as authors (please go to http://member.goodpractice.net/HEaTED-information/Welcome.gp for more information).

The VLE is also the home to a number of different forums or discussion groups, the purpose of these are to try to bring the wider TSM community together as a whole to share good practice and information. This has the potential to become an extremely valuable resource for TSM but is solely dependent on their engagement with, and contribution to the site. There are already contributions to discussion forums and publication of material on the site but there is scope for much more.

Contribution to the site has massive personal benefits for individuals, raising their profile, and a publication on the web based on expertise is a huge boost to anyone's CV and career prospects. Submission is easy, if you would like to get yourself published and recognised in your area of expertise please see http://www.istonline.org.uk/HEATED/heated_vle_submission.htm for information on how to submit or contact me or Ken Bromfield (contact details listed at the end of this article).

A new Continuing Professional Development Programme was launched in 2008

You are probably aware that within other professions staff are often required to take part in a CPD programme in order to retain their professional standing (e.g. teachers and doctors). No such scheme currently exists for technicians, but as part of the project which aims to 'professionalise' a career as a TSM (one of the major concerns for TSM in the 2006 survey was one of professional standing) a new CPD programme has been developed which is accredited by the IST. Although only recently launched it is hoped that the IST CPD programme will eventually be fully recognised as a valuable 'qualification' and evidence to prospective employers, of the TSM's professional standing.

This new inclusive (in that it is designed to cater for TSM at all levels) programme is based on job profiles, and involves candidates using real work based evidence and experiential learning. The programme is designed to help TSM address their personal and professional development (another important issue from the 2006 survey). By providing a mechanism to keep pace with issues surrounding a changing role, and by developing transferable skills that can apply to other technical roles, the programme can help TSM to develop both within their current role, and into new roles either above or sideways into another specialist area. Once signed up to the programme candidates can enjoy easy on line access to fully resourced and mapped learning materials.

This programme is not limited to those in HEIs. To find out more visit the IST website, http://www.istonline.org.uk/CPD/CPD.htm.

The HEaTED team

The work of the HEaTED project has been, in the first instance funded through HEFCE, with advice and support provided by a Steering Group. The Steering Group, recently renamed the Management Group, is chaired by Professor Keith Burnett, Vice-Chancellor Sheffield University, and comprises a broad spectrum of staff from UK HEIs (staff developers, HR managers, Technicians and Technical Managers) with representation from HEFCE. The second round of funding from HEFCE was provided in part to appoint key team members including an Executive Director, a strategic post critical to the success of the project and a Skills Development Manager whose remit is to focus on the provision of an enhanced skills programme. In March this year the Management Group were pleased to announce that Matt Levi was appointed to the post of Executive Director, followed by my appointment as the Skills Development Manager in April.

With these two appointments the project is now at a stage where it is moving forward so as to build on its early successes. Apart from me and Matt there are a number of other team members contributing to the project, Bob Hardwick, HEaTED Project Consultant, John Robinson, HEaTED Management Team Member, Ken Bromfield, HEaTED VLE Consultant, Christian Carter, HEaTED Survey Consultant, and Joan Ward, HEaTED Administrator and VLE Consultant.

Over 50 HEIs have signed up for the HEaTED resources.

With the imminent launch of the next TSM survey in June 2009 and the appointment of Matt Levi as Executive Director and me as the Technical Skills Development Manager we are at a crucial stage of the projects development. Now is the time when the project needs to ensure that we are truly engaging HEIs in the project. To date over 50 HEIs have signed up to the HEaTED resources and it is expected that many more will follow.

HEIs are being asked to pay a fee to sign up for the HEaTED resources, the amount depends upon the number of technical staff within the institution. The uptake of this resource is central to the overall success of the project because it has been clear from inception that any such project would not have continuous funding through the government and must seek to become self funding. Once an institute signs up for the HEaTED resources, staff within the institution have full access to the VLE, a discount on most of the Technical Skills Courses and a discount on the fees for the CPD programme.

A number of HEIs have held conferences for technical staff (Manchester, UCL, Sussex and Leicester to name a few) and many have used this as a platform to spread the message about the HEaTED project. It is hoped that many more will follow suit and the HEaTED team will be contacting institutes to encourage and facilitate such events.

Summary

This is a groundbreaking, one-off project that has huge potential to benefit both HEIs and their staff and is an exciting time for the IST, now home to the project. With benefits for current and new IST members who will get the discounted rates on the CPD programme could potentially have access to all the HEaTED resources.

Achievements to date

- A partnership with the IST
- Launch of the second Nationwide HEaTED survey in May 2009
- A short course series established with IST, with lots more events to follow (http://www.istonline.org.uk/TSCP/technical_skills_courses.asp)
- Development of the Virtual Learning Environment
- Recruitment of a HEaTED Executive Director and Skills Development manger
- An online CPD programme for technical specialists
- HEI membership of over 50 member HEIs, with more joining every week
- Regional collaborative events in partnership with a staff development forum
- A technical specialists mail base for networking HEaTED
- A growing presence at major UK technical events
- Further pump priming funding from HEFCE to help roll out our ambitious programme
- A successful UK wide conference for technical specialists, staff developers and HR professionals, with over 300 delegates attending the Manchester event in 2008

Work in progress

- 'Training the technical trainer' workshops
- Training needs analysis through specialist technical groups
- Development of additional membership services

The HEaTED team would welcome any feedback, suggestions and offers of material for publication on the VLE or to provide training courses. I am looking forward to working on something that could impact in a very positive way on the working lives and careers of technicians, technical managers and specialist staff in HEIs.

Contact details

Matt Levi
HEaTED Executive Director
m.r.levi@exeter.ac.uk

Michelle Jackson
HEaTED Skills Development Manager
michellejackson@istonline.org.uk

Bob Hardwick
HEaTED Project Consultant
r.c.hardwick@sheffield.ac.uk

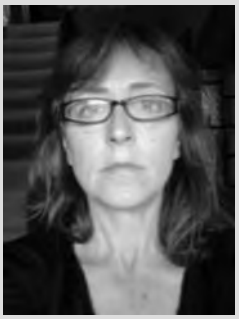
Ken Bromfield
HEaTED consultant (VLE)
Heatedtechkb@aol.com

Joan Ward
HEaTED consultant (VLE and admin)
office@istonline.org.uk

John Robinson
HEaTED Management Group Member
john.robinson@manchester.ac.uk

Christian Carter
HEaTED Survey Consultant
christian.vourneen@btinternet.com

Michelle Jackson



Following a degree and PhD in Biochemistry from the University of Manchester Michelle worked as a researcher in Universities and the NHS. In 2003 she was appointed as a Technical Resources Manager at the University of Manchester until she left in November 2008 to work on the HEaTED project. In 2007 she became a Fellow of the Institute of Science and Technology and acts as an assessor for their Continuing Professional Development programme.

Adaptation, Fitness, Inheritance and Survival:

Can basic Evolutionary concepts be applied to the development of Science Technology?

Kevin Fletcher

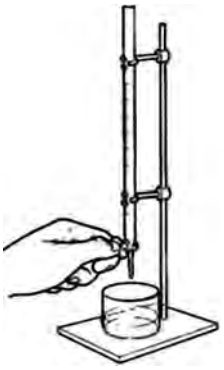
Evolution in a biological sense means change in the characteristics of descendant populations of organisms. It involves natural selection as a major part of that theory. Perhaps such concepts can also be related to science technology practice in terms of its possible development and direction? In other words; its evolution.

Adaptation and fitness may play major roles in such theories, regardless of their application. The purpose of this essay is to illustrate the contribution these two facets make in terms of their contribution to the development (evolution) of science technology practices, using biological concepts as a framework for discussion.

First of all let us consider past science technology practices in evolutionary terms of being obsolete ("extinct"). Adaptations and developments in science technology in the past might be thought of in a similar fashion to a fossil record. Where there are no living specimens (i.e. where practices have become obsolete), identifying adaptations (practices) developed by previous generations of science technologists becomes measurably more difficult when "fossil records" are relied upon. I must be careful here not to imply that previous generations of science technologists are "fossils" (I apologise to my senior colleagues if this has been implied but it is not the intention) but unless records are in evidence of previous practices and why they evolved, we can only guess at their value as an adaptation to a specific context. In the same way we can only guess from a real fossil record about the value of adaptations in extinct species.

Also, in a fossil record, preserved footprints are sometimes able to provide information about an individual's behaviour or journey, but it is often difficult to determine which organism is responsible for which set of tracks. Even if living relatives of extinct organisms still exist, it is possible to make only educated guesses about adaptations. The same may be said of our science technology past; that preserved "footprints" (records, anecdotes, manuals or journals) can provide some clues about past practices, where and why they evolved and to a limited degree, which members of our profession were responsible for their development and furtherance. There is similarity, therefore, in the difficulties in examining a real fossil record and examining existing partial records of now extinct and obsolete science technology practices or developments.

Turning now to adaptation as a concept that might be applied to science technology practices: adaptation can be defined as a matching between an organism and its natural environment. Each species has a different combination of characteristics, many of which may be related to some feature of its habitat or lifestyle but, because each individual is unique, it is difficult to establish any generally applicable ways of investigating and identifying adaptations. There does, however, seem to be a common basic plan for groups of organisms and any variations of the basic plan might be related to particular functions.



In terms of science technology, this may mean a matching of staff skills, expertise or experience to current contextual needs. A member of staff may therefore adapt or use a specific set of skills in a given environment. For example, a specific set of science technologists' skills may be used more in a medical context than in a school science laboratory or a new piece of apparatus may transform a particular method of analysis. Thus science technology staff skills are matched to the context in which that science technologist finds him/herself. Furthermore and similar again to species adaptations (which can be studied with a view to looking for generic adaptations), science technologists' skills may also share some common facets because they become "accepted practice" within a given context.

There has to be a matching of the organism (the science technologist) with her/his environment (employment context), if that "organism" is to be successful and survive (successful, perhaps, in terms of carrying out science technology tasks and survival being in terms of remaining in desired employment or of promotion!).

As part of his wide ranging theory, Charles Darwin seemed to believe that organisms with advantageous features had a greater chance of survival in the struggle for existence. Again, this might also be considered true in science technology; in that a new practice can give the science technologist who devised it (or those who keep abreast of such developments and use such practices in their employment) an advantage over their peers. This is again in keeping with the fundamentals of Darwin's theories and shows the basic concepts might be applied to science technology in a similar way.

Turning now to fitness as an evolutionary concept and one that we might also be able apply to the "evolution" of science technology, we need to define what fitness is. A central tenet of Darwin's theories was that some individuals are fitter i.e. they are better adapted or have qualities that promote survival. This means fitter individuals survive more successfully in their particular environment than other similar organisms. Again, we could overlay this concept on science technology development with a consideration of science technologists who keep abreast of new practices and developments in the profession. Individuals who create or bring new practices to specific environments which lead to improved efficiency or results for example, can be thought of (in evolutionary terms) as being "fitter" i.e. being better adapted or having qualities that promote their survival (perhaps in terms of the profession, promotion or job security).

In an evolutionary context, variability in fitness over several years means that biologists must seek to measure the lifetime success of individual organisms by following them over extended periods. Similarly, we can only use this retrospective view when looking at the success of previous science technology practices (and their practitioners!) over time.

It appears, therefore, that over time, adaptation matches an organism to its environment so that natural selection can operate; its outcome being a fitter individual. This process **is** evolution; a change in the characteristics of descendant populations of organisms. Thus adaptation precedes evolution and improved fitness seems to be a consequence of it.

Likewise in science technology, individuals adapt and develop their practices according to the context in which they operate. Contexts can be employment based, roles, responsibilities or even accepted "ways of doing things". The more beneficial practices promote survival and furtherance, so these are likely to be sustained and passed on to subsequent "generations" (of science technologists). This process might be thought of as evolution in terms of it being a change in the characteristics of "descendent populations" (in this case, a change / development of the practices of science technologists of the future).

Whereas, however, such beneficial adaptations are genetically based and inherited according to Darwin in a true evolutionary context, in science technology they might be considered as classroom/ practice based such that science technology learners "inherit" the adaptations (good laboratory practices) and further them in their own context.

This notion can be related back to a previous article in which I reflected on my practices as a teacher (Fletcher, 2008). As a "teacher" the content, quality and delivery of the curriculum have even more significance when it is realised that teaching and learning is the mechanism of "inheritance" for science technology knowledge/ practice in terms of future generations. It places a still greater burden on teachers, as being responsible for successfully passing on desired "characteristics" (science technology practices) to subsequent generations.

In conclusion, it appears that it is possible to use fundamental evolutionary concepts such as "adaptation", "fitness", "inheritance" and "survival" as as one way of considering the development and direction of science technology practices in the past, present and hopefully with a view to the future.

References:

Fletcher, K. (2008) "Was I a good science teacher or was I not? (reflecting on my delivery of earth science and the possible impact of my teaching to Science Technologist of the future)" *The Journal of the Institute of Science Technology, Spring 2007*.

Acknowledgements:

The use of material in the fashion it has been presented here, sprang to mind while reflecting on a course that I completed some time ago. The material and its interpretation is a revisiting of some of the work I undertook for an Open University course called Evolution (S365), but on this occasion, with a view to using basic evolutionary concepts in terms of how they might be applied to science technology practices and their development.

Fossils image taken from www.edupics.com

Burette image taken from www.fao.org

Charles Darwin photograph taken from www.gutenberg.org

1930s laboratory photograph taken from www.hurlstone.com.au

Kevin Fletcher

BA, BSc(Hon), AdvDipEd, MA, MEd, MEd, Cert IT & Comp, FIfL, EurProBiol, CBiol, MIBiol, MIScT.
Doncaster.

Buckyball Sculpture

John Lane

In 2006 The University of Sheffield opened a new research facility at its North Campus and decided to name it after one it's most famous alumni Sir Harold Kroto.

Harold Kroto obtained a first class BSc honours degree in chemistry at the University of Sheffield in 1961 followed in 1964 by a PhD at the same institution. He was made a Fellow of the Royal Society for his distinguished contributions to the spectroscopy of novel and unstable molecules, the discovery of long carbon chain molecules in outer space and the detection and identification of C60 - the remarkable football shaped carbon molecule. It was this work that also resulted in Sir Harold, along with Robert Curl and Richard Smalley, receiving the Nobel Prize for Chemistry in 1996. Sir Harold was knighted in the same year for his contribution to chemistry.

In order to honour Sir Harold's achievements, the University decided to commission a sculpture representing the C60 Buckminsterfullerine molecule or Buckyball as it is commonly known.

Discussions took place between Sir Harold and Professor Bob Boucher, the then Vice Chancellor of the University, about the design of the sculpture, and at Sir Harold's request, a C240 model was commissioned. In fact the C240 molecule has not been discovered, but has been identified as the next theoretically stable molecule in the series. The Central Mechanical Workshop at the University of Sheffield was asked to make the sculpture.

Scaled up so that one metre of the sculpture represents one nanometre in the molecular world, the sculpture, which is one thousand million times larger than the molecule itself, is a physical representation of a pure carbon cage Fullerene (often referred to as Buckyballs).

The fascinating geometry of these pure carbon molecules has inspired numerous sculptures around the world, but this was to be the first ever `giant´ Buckyball.

One of the most senior of the Central Mechanical Workshop staff; Garry Turner, was given the task of designing and building the sculpture, and work began in October 2005. Over the next several months Garry along with other colleagues in the workshop worked diligently, overcoming many obstacles and eventually producing the spectacular Buckyball sculpture which now has pride of place at the entrance to the Kroto Research Institute.

The normal pattern for a carbon-carbon lattice would be hexagonal (like graphite), but the Buckyball arrangement has a pentagon surrounded by hexagons (see Fig 1). Clearly this would present a challenge so, rather than beginning with a C240 molecule, it was decided that if a smaller model of a C60 molecule was made first, it would enable us to learn more of how the materials behaved under load.

Fig 1

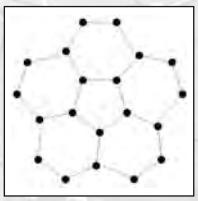
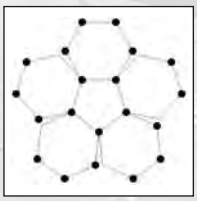


Fig 2



Materials

The first task was to select the appropriate materials for the sculpture. It was quickly established that the most suitable material for the balls, which represent the carbon atoms and join the rods together, was stainless steel. Highly appropriate being that Sheffield was the place where stainless steel was invented.

Three holes 5.2mm diameter were drilled in each of the 240 one inch diameter stainless steel balls at 120 degree angles in order to accommodate the 5mm diameter joining rods. Additional threaded holes were machined in several of the balls to act as anchor points for the mounting of the sculpture.

This facilitated easy assembly of the hexagonal sections, but caused considerable strain for the pentagonal sections.

Initially it was intended to use carbon fibre for the joining rods, particularly as C60 is the third form of carbon, but it was soon discovered that carbon fibre was incapable of bending to the required radius. Several rods failed under stress and early signs of fracture were observed on others.

The next material selected was glass fibre. Several different grades were tried with varying degrees of success, before a suitable one was found which would not only bend to required radius but had the correct appearance.

Rod Length

The rod length had to be calculated to give the chosen diameter of the sculpture, which was initially 1 metre. This proved to be quite a challenge. The structure of the sculpture; a "lumpy" dodecahedron, had to be first understood and then analysed.

The accuracy of the calculations was proven in that the chosen diameter was achieved first time. However, during manufacture it soon became apparent that it was a little on the small side for its chosen position outside the Kroto building, so the decision was made to change the diameter to 1.5 metres.

Assembly

The assembly of the sculpture proved to be the greatest challenge of all. The assembly of the planer structure (see fig 2) was relatively straightforward. This then had to be pressed into shape so that the rods located properly in holes in the stainless balls.

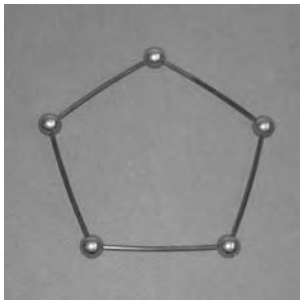
An assembly jig had to be made to facilitate this operation, as the stress induced in the rods was considerable.

An initial "dry" assembly was undertaken to prove both the structure and the assembly technique. This identified the need for some method of holding the rods in place during assembly. Cable ties proved to be the easiest solution.

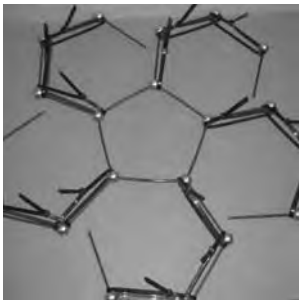
It was then necessary to determine what type of adhesive would be suitable for securing the glass fibre rods in the stainless balls. Consultations took place with representatives of various adhesive manufacturers before a suitable one was found. A slow setting epoxy resin was chosen, as it was estimated that final assembly would take about three hours.

Under the direction of Garry Turner, two teams consisting of all the workshop staff were set up, one team assembling the individual sections and the other fitting the sections together. Everything was set up prior to assembly and each team member knew what was expected of them.

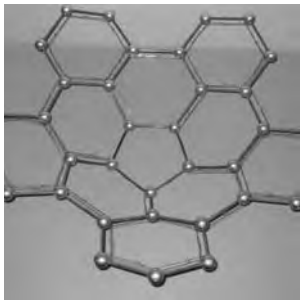
In situations like this you would expect that everything would go like clockwork, and that the sculpture would be assembled without incident and in a fraction of the time anticipated. Well believe it or not, that's exactly what happened. The whole assembly took slightly more than an hour, and we were all eating bacon sandwiches by mid morning.



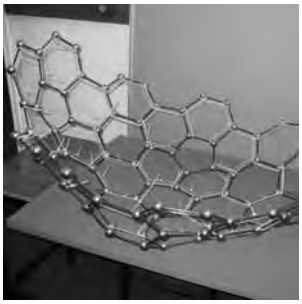
Pentagon



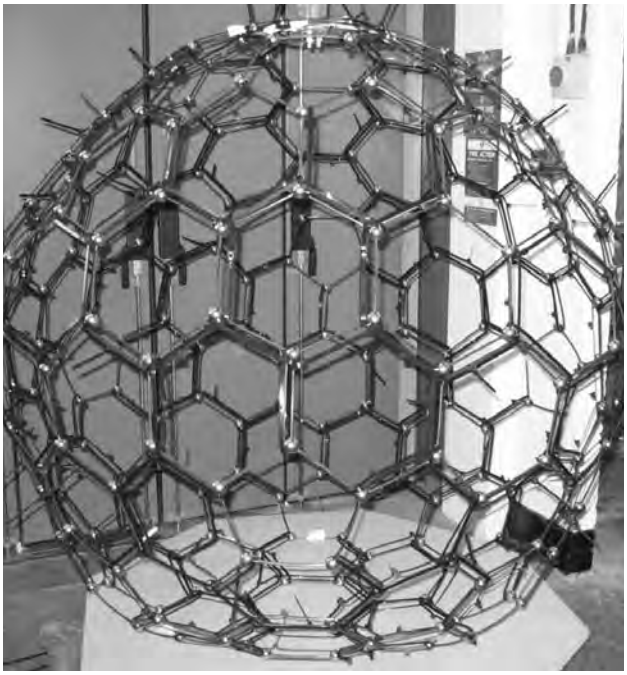
Pentagon with hexagons in place



One complete section



Halfway there



Complete assembly with cable ties

Installation

The sculpture was to be sited at the entrance to the Kroto Research Institute directly above a chrome spiral handrail. It was to be suspended on wires from above and secured in place by wires below to anchor points. After some research it was decided to use a commercially available system using 3mm diameter stainless steel wire with hooks and grippers, utilising the additional threaded holes in several of the stainless steel balls strategically placed on the sculpture. The whole structure was firmly secured by tensioning the wires.

The university's Estates department prepared the ground around the site and uplighters were installed. As the finished sculpture was somewhat fragile, it was thought unwise to transport it in a vehicle, so a team of technicians carried the sculpture the half mile from the Central Mechanical Workshop to the Kroto Research Institute where it was installed.

En route

Unveiling

The sculpture was officially unveiled by Sir Harold Kroto himself at the opening ceremony of the Kroto Research Institute on a beautiful sunny day in June 2006. Sir Harold declared himself very happy with the finished sculpture, complimenting all those involved in its construction. He was particularly happy that the "lumpy" shape of the molecule, caused by the combination of hexagons and pentagons in its structure, had been reproduced accurately. This was most gratifying to hear, as most observers upon first seeing the sculpture regularly comment that "it would be nice if it was round", which of course it is not intended to be.

Three years on, the sculpture remains the main feature and talking point of all who use the Kroto Research Institute, and to quote Sir Harold:

"It is a fitting emblem, highlighting the importance of the Nanoscience and Nanotechnology research being undertaken in the Institute and the exciting promise of these cutting-edge research areas for combating the major socio-economic and humanitarian issues, such as environmental remediation, remedial medicine and advanced materials that now confront us."

Apart from an annual clean up and re-tensioning of the wires the sculpture has needed no additional maintenance. This is much to my surprise, as I fully expected it to be summarily removed and rolled down nearby Broad Lane by inquisitive students trying to establish how durable it was under stress.

This probably says as much about the behaviour of the students of today as it does about the behaviour of students of my era.

Opening ceremony

Left to right: John Lane (Central Workshops), Sir Harold Kroto, Garry Turner (Central Workshops) and John Mignanelli (Estates)

The team

From Tobacco to Test Tubes – The Gallenkamp Story

PART TWO – THE YEARS UP TO THE END OF THE SECOND WORLD WAR

Alan Gall

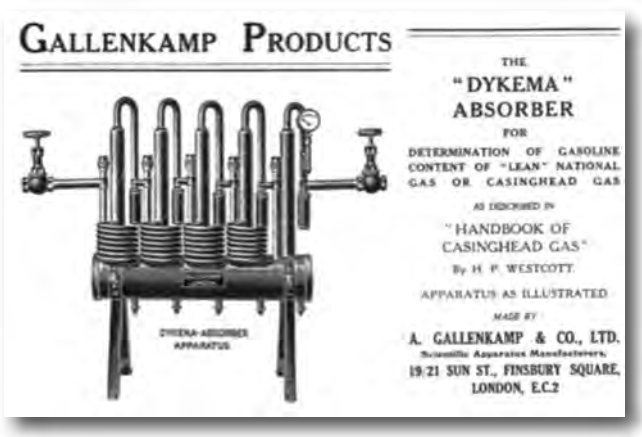
Part one revisited

In Adolf Gallenkamp's homeland, the 1870s saw some truly momentous events. The decade began with the French under Napoleon III declaring war on Prussia, only to be humiliated by swift military defeat. To press home the advantage, the Prussian army marched on Paris and laid siege to the city. France signed an armistice the following year and William I, King of Prussia, was proclaimed German Emperor at Versailles. Germany, Russia and Austria-Hungary then formed a coalition (the Three Emperors' League) that would be one of the early steps towards creating the conditions for the eventual outbreak of World War One.

Against this turbulent background, Adolf made his way to England where he later joined two other Prussians – Gustav Krussmann and Oscar Werth – importing Havana cigars, based at premises on Queen Victoria Street, London. Aldolf's partners soon left the business and within a few years he had switched to the supply of gelatine, a material gaining importance with the development of photography. Again, this was short-lived and by 1885 A.Gallenkamp & Co had turned to the supply of scientific apparatus.

The early catalogues offered products from both home and abroad, with no clear evidence of Gallenkamp-made items. Although a London directory entry of 1886 describes the firm as 'chemical apparatus and thermometer makers' this activity must have been on a very small scale (if it actually existed) and did not become significant until products started to flow from factories established in 1911 (for furnaces and metalwork) and 1913 (for glassware).

Adolf Gallenkamp stepped down from management of the company during World War One because of his German origins. The business, however, continued to expand under the control of James Davies and Harry Grant Jarrom, the husband of Adolf's daughter Bertha Ellen. Frank Dixon also became a director during this period.



Advert 1927

The war had shown how dependent Britain had become on foreign imports of laboratory apparatus. 'Could we have won the war without British-made chemical laboratory glassware?' queried the Birmingham laboratory supplier Standley, Belcher & Mason Ltd in 1920, and pleaded 'Ask the Works Chemist (the man who knows) what the position was in late 1914 and early 1915. Do not let this Country be again dependent upon supplies from abroad.' Similar sentiments were to be repeated with the advent of the next war.

The story continued

Ownership of the company at the end of 1919 was split between 26 individuals. Adolf Gallenkamp held about a third of the shares, James Davies and Harry Jarrom around 20% each, and the balance was divided amongst the rest with no one holding more than 3%. The year 1923 saw the appointment of two new directors, Harry James Hornby and Edward Arthur Pearce, to join Davies, Jarrom and Dixon. There were also several new faces at Gallenkamp in the late 1920s: Herbert Kirby (1926), Alec Rundle (1928) and Stanley James Davies (1929). The last named was the son of James Davies who had been responsible for introducing a number of new products. Stanley Davies became a director in 1934 and continued the family tradition of technical development.

Gallenkamp had set up a factory in 1913 at 6-12 Providence Place. This was closed at the end of World War One, and extra premises then found at 26 and 28 Tabernacle Street, within 250m of Providence Place, to the west, and about 300m northwards from Sun Street. Most production was moved there, leaving more space for offices and storage at Sun Street. By 1930 the Tabernacle location had been vacated and manufacturing taken to a new factory called 'Technico Works' on Worsley Bridge Road, Lower Sydenham, originally in Kent but now London SE26. Electrically heated apparatus came from a factory at Chalfont St Peter, on the corner of Lower Road and Chiltern Hill near the village centre. Details of these facilities were published in 1963: 27,000 square feet floor area at Lower Sydenham and 15,000 square feet at Chalfont.

The workshops on Tabernacle Street were next-door to the National Telewriter Company Ltd, formed in 1909 to rent-out an electrical device called the Telewriter. A forerunner of the facsimile machine, this instrument allowed the operator to send hand-written messages over a telephone line. It is not known if Gallenkamp became a customer for this innovation but the apparatus did gain a foothold in some well-known establishments like Fortnum & Mason, Harrod's and the Army & Navy Stores.

Technico House on the corner of Sun Street and Clifton Street, late 1920s/ early 1930s

By the mid 1930s, the Gallenkamp catalogue had reached the 11th edition: 2½ inches thick, 1900 pages and 3.6 kg in weight. On the first main page could be found the warning: 'This catalogue is strictly confidential, and without our consent must not be passed on to any person, and moreover, not rendered accessible to trade competitors. Contravention of this condition is liable to prosecution under the provisions of the International Copyright Law.'

Ninth edition (1931) of the Gallenkamp catalogue with 1472 pages

The variety in the catalogue was staggering. When buying common glassware (such as beakers, flasks, retorts, etc) the customer could choose from Chance Brother's 'Hysil', James Jobling's 'Pyrex', 'Monax' from Perth based manufacturer John Moncrieff, or British 'Schola' from Wood Brothers of Barnsley. Even with filter papers, there was a generous selection of brands: 'Whatman' (made by W & R Balston), Munktells (of Sweden), 'Separa', J.Barcham Green's, 'Postlip', Allnuts of Maidstone and for those with expensive tastes, the French-made papers from Bernard Dumas. Amongst the more unusual items were: the 'Enterprise' tinned meat chopper, a water-driven bottle-shaking machine, a wax moulding of children's scabs and an apparatus for investigating the temperature changes in freezing potatoes,

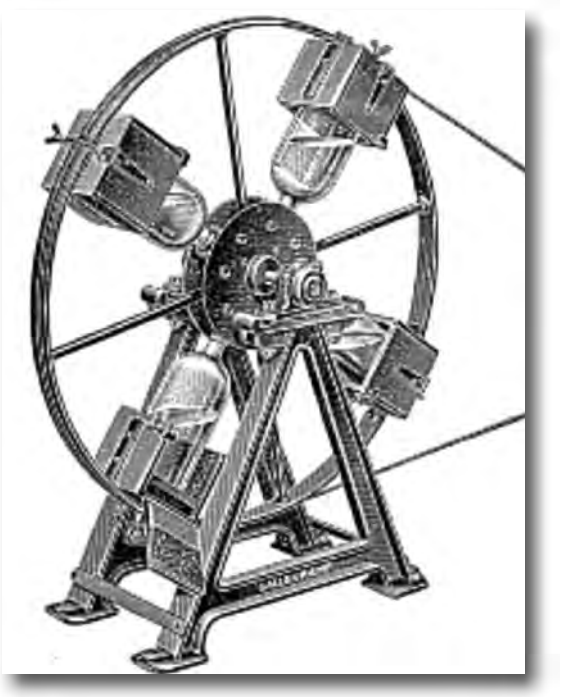
An interesting feature of the catalogue is evidence of the crude effort, made occasionally, to scratch out some of the manufacturers' names on the original illustrations. Barely visible is the name 'Cooke, Troughton and Simms on a metallurgical polishing machine, for example.

On 23 January 1935, Charlotte Gallenkamp died after 56 years of marriage to Adolf. He survived her by two years, dying on 26th February 1937 at Littlecot', 11 Flower Lane, Millhill, Hendon. His Will gave instructions for 'Littlecot' to be sold and directed that the money raised, together with the shares in A.Gallenkamp & Co Ltd, should be divided between his three children: Bertha Ellen Jarrom, Edith Tappenden and John Wilhelm Gallenkamp. Alternatively, any of the three could make a bid for the house on a first-come first-served basis, the value to be taken from their total inheritance. John, of course, had moved to Canada in 1912 and the Will reveals that he had two stepdaughters Leslie and Daphne. The net value of Adolf's personal estate was finally given as £40100, a sizable sum equivalent to more than 400 years of salary for an office worker in a junior position.

Bertha received an unusual extra bequest. Adolf left his daughter two graves; one at Abney Park Cemetery, Stoke Newington and one at St.Pauls churchyard, Ridgway, Millhill. It was at Abney Park that little Dorothy Gallenkamp had been buried, aged six, in 1890.

When the Second World War was just a few months old, school-leaver Doug Cutts searched the jobs section in the newspaper and found that A.Gallenkamp & Co Ltd required staff. The hours were 8 am until 6 pm weekdays, an hour for lunch and an extra half-day to be worked on Saturday mornings. At the age of 14, Doug started as a checker in the warehouse on 18 shillings per week. He recalls: 'Tea was brought round on a trolley and we were allowed a few minutes to drink it. The tea was disgusting and I have never had such tea elsewhere in all my life, including Army tea!'

Because of the Blitz, most of the office functions, such as purchasing, accounts and general administration, were moved to the sports pavilion of Birkbeck College, at Greenford. What remained consisted of offices for handling customer correspondence and processing orders. Says Doug: 'The managing director had his office in the building [Sun Street]; he was Mr H.J.Hornby. Alex Rundle was also with us, so was old Mr Meade who spoke fluent German and was Head Buyer.'



A bottle-shaking machine designed to be driven by a 1/40 Horse Power motor via a thin cord. Illustration from the 11th edition catalogue.

Gallenkamp's original Sun Street location numbered 19 and 21. Up to 1924 the next-door building at number 17 was shared by several small businesses.

This property was taken over around 1927 and numbers 23 to 29 in Sun Street and 1 to 3 in Clifton Street (6 separate premises) demolished for the construction of a new extension. As can be seen from the picture, the extension appears to be much larger than the two older buildings combined, but largely due to the effect of perspective the actual increase in ground area was only about 70%. These additions had been completed by 1929 and in 1930 new showrooms were ready for customers to inspect some of the remarkable number of products available. Doug Cutts is able to describe life at Sun Street when he first started working there.

We occupied premises at 17-29 Sun Street and 1-3 Clifton Street, these streets meeting in Sun Street. Number 17 was known as the old building and was not connected internally to the rest. The ground floor was used for storing packing cases and goods packed for export, waiting for letters of credit and, now it was wartime, for shippers to request delivery to their premises for placing in a convoy [of ships], all very hush-hush of course. There was a hand-operated hoist to take goods up or down. The first floor was a stock room for physics apparatus and the second floor was let to a printer. The third floor was one small room used as a rest room for the young male members of staff to eat sandwiches in the lunch hour. Later this was taken over for accommodation of stock and we never again had a rest room for male staff only for female staff, presumably because they could scream louder.

So this was Gallenkamp in 1940. Previous to this the firm had grown beyond the capacity of number 17. Even the space below the floorboards of the ground floor was chock full of broken glass, where it was methodically stored rather than pay to have it taken away as breakages were part of life.

In this early stage of the war it was feared that the German name of the company would create a boycott, so we were all told that it was not German but Dutch, and should say so to any customer who asked questions.

By luck, the Gallenkamp premises escaped serious damage during the Blitz. Employees acted as fire watchers and when an incendiary hit number 17, this was quickly extinguished. Over at Hatton Garden, competitors Baird & Tatlock (London) Ltd were not so fortunate. They suffered four direct hits from heavy bombs and further destruction when V1 and V2 weapons landed nearby.

In 1938 Alec Rundle was appointed to the board of directors and would eventually become the MD. The following year, Geoffrey Adams joined the firm and the appointment of another director, Horace Sydney Cornford, was approved. If anyone deserves the honorary title of 'Mr Gallenkamp' it must be Horace Cornford, a well-liked employee, who had spent 37 years working his way up to director level and went on to achieve 56 years of service before retiring in 1958. He had a cleft palate that made his speech difficult to understand by newcomers but those who were familiar with his articulation were always willing to interpret.

As the war entered its final stages, staff began returning to Sun Street. Doug Cutts noted in his diary for 11 January 1943 that the place was suddenly awash with personnel who had been temporarily housed at Birkbeck College's sports pavilion to avoid the dangers of central London. Air raids were still continuing, but not with the same intensity.

Even 70 years after the events, Doug hasn't forgotten the shear exhaustion that he experienced as a young man attempting to do the work that in normal times would have been unthinkable. Sustained by meagre food rations and deprived of sleep by the aerial bombardment, he endured the years before being called up.

One day I did so much that when the van driver and I loaded the van for the N.London round the van could not be driven as the weight had squashed the springs down and the mudguard arch was pressed down on the rear tyres!

We had to unload all the nearest deliveries and take them in again, to be loaded again the next day so that they could be delivered with the east London round, which was lighter. The work was so arduous that I found army training quite acceptable.

The story continues with part three in the next journal.

The introduction of standard ground glass joints enabled apparatus to be quickly assembled without the hazards of boring holes in cork or rubber bungs. This advertisement is from 1932.

Acknowledgements

Thanks are due to:

Pep Gallenkamp for details of the family history.

Stan Miller for on-going help with the history of the industry.

A special thanks to ex-Gallenkamp employees who have given continuing support as well as information:

John Barlow.

Eric Borradaile-Jones.

Doug Cutts.

Chairman's Annual Report

APRIL 2009

John Robinson

The last twelve months have seen the most significant developments in the Institute that I have ever experienced. For "ever" read "since I joined in the early 1980's"; don't ask me exactly when, I'm sure it's in our membership database if I really need to know. The reasons are, of course, such issues as our partnership with the HEaTED project (www.istonline.org.uk/heated), our engagement with the sector skills council's Lifelong Learning UK (LLUK: www.lluk.org) and the Science, Engineering and Manufacturing Technologies Alliance (SEMTA: www.semta.org.uk) plus a number of other promising collaborations including discussions with the UK Science Park Association (www.uksspa.org.uk) and Scientific & Chemical Supplies Ltd (www.scichem.com).

Firstly, the HEaTED project, which has successfully obtained almost a quarter of a million pounds of funding from the Higher Education Funding Council for England to develop a national resource for technical staff education, learning and skills development. Talking to members and others about the HEaTED project and our relationship with it I keep getting feedback that it appears quite a complicated relationship. At one level it might be, and in fact it may even turn out eventually to be more complicated (but we won't go into that here). We should, however, take it at face value; it's a verbal agreement between HEaTED and IST to work in partnership for a common goal. This, if you remember, is all about raising and enhancing the professional profile of our members. So there it is; no contracts, no lawyers, no legal agreements (no hefty fees!), just a commitment. The more prudent of you will no doubt be asking at this stage "Isn't that a bit risky?" Well, yes, it is. But we believe that it's a risk well worth taking, after all what, or who, is HEaTED? How did it come about? And who are the players? The truth is that it is what it says on the tin; a HEFCE project, pure and simple. Furthermore, all those who have made HEaTED are IST members and I won't spare any blushes; our very own president Bob Hardwick has led it from the outset. We owe him a large debt of gratitude, as we do to Matt Levi who has also delivered above and beyond the call of duty.

If you are not in the HE sector you may think all the above isn't relevant to you, but I can reassure you that it is. Apart from raising the professional profile of technical staff across the spectrum, we are committed to ensuring that all our members benefit from this initiative regardless of who or where their employer is. We think we have all the angles covered to ensure this, but the real test will be with you – our members. If a problem arises, let us know; phone call, email, web or good old fashioned letter; keep in touch and tell us what you want.

The latter of course is critical. This will go nowhere without the engagement of the technical community wherever they may be; you need to ensure that we deliver what you want. So far we have got an excellent package; an increasing number of technical skills courses to attend, a growing virtual learning environment (VLE) or web resource, a Certificate in Technical and Laboratory Skills and a CPD programme. It's a damned / very good start but it needs to grow and it's only going to grow if you use it and contribute to it. If you and the technical community as a whole don't, it will wither and fade away and we may never get another fantastic opportunity like this. And while you're at it, try to recruit another member! There are loads to tell them about and lots of exciting initiatives to get involved in. And it's the cheapest membership fee of any comparable professional organisation!

You may have noticed I have not, this year, used the usual annual report format that I have in the past; the good old standard of look back, take stock and look forward. I've just pitched in with what comes naturally. Maybe that's because I received the annual report from the building society this morning and it was unbelievably dull. Very glossy and in full colour, but had nothing readable or interesting in it at all. So maybe that's why I have departed from the traditional. Apologies if you're a traditionalist!

I think it would be remiss of me though not to mention the past year though, which has actually been an incredibly good one. Our Certificate in Laboratory and Technical Skills continues to be developed and although uptake is progressing slowly through FE colleges interest is still high and continually increasing. We have also had approaches from a few colleges who would like us to work with them to develop other training schemes.

LLUK has expressed an interest in developing apprenticeships and this is of particular interest to a number of employers who are beginning to understand that there really is a skills crisis looming and are looking to recruit trainees. The new criteria for apprenticeships which are due to come online are much less restrictive than previously and it will be possible to obtain 100% funding for education and training costs in many cases. Following a very

successful meeting with LLUK in London we have been invited join their panel to look at further development of skills and training opportunities.

SEMTA is currently developing a new Science Diploma which is intended to provide 14 – 19 year olds with knowledge and skills which will prepare them for both employment and higher education – perhaps we will at last see a bridge across the vocational/academic divide, though it will be no simple task to change the views and culture of some 150 or so universities and colleges. I may not live long enough! The current debate in the review concerns the maths content and there are opposing views on how this should be integrated. We await the results with interest.

Our contact with UKSPA is really the first move towards developing our membership in the industry sector. There is a significant number of technical and similar staff out there, often isolated in SMEs (Small to Medium size Enterprises – note how I'm getting fluent in acronyms already!) and this link will enable us to get closer and find out what support they need from a professional body. If you are out there, please get in touch.

Last year saw the launch of a new membership service; mentoring. There are a number of experienced members who are prepared to offer support free of charge to other members. If you would like to talk to a mentor get in touch with our office. Information will be appearing shortly on our web site but you don't need to wait for that to be supported; just give us a call and we'll find a mentor best suited to the field that you are in. Worried about the implications? Don't be; there aren't any - you remain in the driving seat at all times. You don't have to do anything or meet deadlines or produce reams of paperwork and it's all confidential. All our mentors will have agreed to abide by our guidelines. We feel that under the current global financial crisis increasing numbers of our members (and the rest of the world!) will be concerned about the safety of their jobs. If that's a risk, now is the time to think about your career development. Actually, that time was the day you started your current job, but nobody's going to beat you up about it. You need to be thinking about your CV; is it up to date? Is it full of transferrable skills? Is there evidence in there to separate you from the crowd and get an interview? Can you demonstrate you can run the extra mile? I recently had a look through a number of job adverts on the web; just take a look at the person specifications that employers are asking for. Aside from technical expertise, experience and qualifications, note how important soft skills are becoming. Phrases like "ability to communicate at all levels", "organisation skills essential", "problem solving skills will be important" and "good team leadership skills required" are becoming common. Have you got evidence in your CV that will demonstrate your abilities in these areas for your next job application?

In order to promote and encourage professional development for existing members in all areas of employment, we provide a service to record your Professional and Personal Development and we have made entry to the Register of Competent Practitioners available to members working outside science.

Our finances this year have seen a major change as we see Institutions joining HEaTED via our office. The net result is that our turnover increases massively – but then so has our expenditure; the take home message is that financially we are currently very sound indeed, which is good progress. It will be important, as time progresses, to keep an eye on the underlying core of IST activity. If HEaTED continues to expand at the current rate it will rapidly dwarf our non-HEaTED finances and we must not lose sight of our traditional membership base and activities; HE as a sector is only around a third of our membership at present although it is the largest identifiable membership group.

What lies in the future then? Well, the only thing that we can rely on is that change will be the only constant and that the membership will drive or respond to change as appropriate. We have seen some fairly rapid change in the recent past and more is likely to come; we should bear the processes of natural selection in mind (interesting that this is 200 years post-Darwin) and position ourselves so that we can be flexible and adaptive.

Notwithstanding the above, I would like to end on a traditional note, which, of course, is one of thanks to all those people who have worked so hard to keep the Institute active and in a sound position for the future. In particular I would like to mention Wendy Mason and Joan Ward who respond so well to sometimes difficult administrative tasks, often with very short deadlines, members of the Executive, the Education and Marketing Boards and of course all our members, even if you just support us by paying your annual membership subscription. It's all supportive, it all counts and it all contributes to an Institute that we can be proud of.

John Robinson
April 2009

New Vice Presidents

At the Executive Meeting held in April it was unanimously agreed that Ian Gray and Terry Evans be made Vice Presidents of the Institute with immediate effect. We are delighted to be able to honour them both in this way and to record our thanks for their valuable service to the Institute, the Executive and the Council prior to that.

Darwin in the Molecular Age

Stephen J Gamble

ABSTRACT

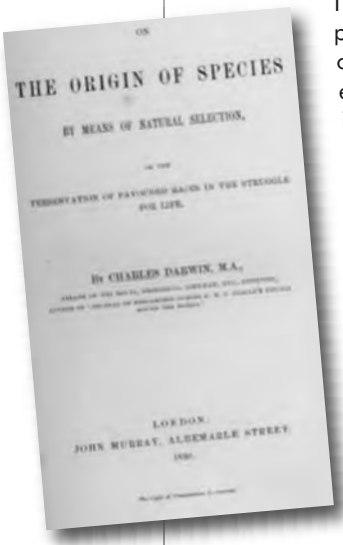
Darwin, and independently Wallace, developed the theory of evolution without understanding fully the mechanisms by which it worked. Today the mechanisms of inheritance and evolution in organisms are better understood. Evidence is examined to establish if the theory of evolution still holds in light of these new understandings.

INTRODUCTION

In 2009 both the 150th Anniversary of the publication of the theory of evolution and the 200th Anniversary of Darwin's birth are being widely celebrated. How has the theory survived the last 150 years?

In 1859 Charles Darwin published his book "The Origin of Species" (Darwin, 1859). Its full title is "On the Origin of Species by Means of Natural Selection of the Preservation of Favoured Races in the Struggle for Life". This one sentence probably encapsulates the basic principle of evolution, survival of favoured characteristics. It is the basis of the Theory of Evolution (henceforth The Theory).

Darwin's voyages on HMS Beagle in the 1830s formed the basis for much of his research for The Theory. Darwin was recommended for the Beagle voyages by his mentor at Cambridge University, the Rev John Stevens Henslow, who was Professor of Botany. Although Darwin is primarily thought of as a biologist he was interested in various branches of the natural sciences and in addition to his biological specimens also brought back many geological samples.


ON
THE ORIGIN OF SPECIES
BY MEANS OF NATURAL SELECTION,
OR THE
PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.
By CHARLES DARWIN, M.A.,
LONDON:
JOHN MURRAY, ALBEMARLE STREET.

Following these voyages Darwin returned to England where he supplemented this research with further extensive studies including work on barnacles and pigeons. Darwin spent many years formulating his theory, but was finally spurred into action in 1858 when he received a letter from another naturalist, Alfred Russell Wallace, who announced that he had formulated a theory of evolution. Darwin's and Wallace's work was presented in public for the first time as a joint paper to the Linnean Society meeting in London on 1st July 1858. Darwin acknowledged that The Theory as published was not perfect and devoted a chapter in the Origin of Species to what he saw as "Difficulties of the Theory".

It is important to note that neither Darwin nor Wallace understood the mechanisms by which evolution worked. In the years since the publication of The Theory many of the mechanisms involved in evolution have been discovered.

THE CORE OF THE THEORY

The Theory is often summarised by using one of Darwin's own chapter headings "Natural Selection or Survival of the Fittest". If a minor genetic mutation gives an organism some form of advantage, however small, over others of its type then there is more chance that it (and hence its offspring) will survive. This introduces an important point about evolution. An adult human probably contains hundreds if not thousands of genetic mutations, many in parts of the genome which appear without function, spread amongst its cells. But it is only mutations that alter the germ cells and get carried forward to offspring that are involved in evolution.

The Theory relies upon the idea that at some point in history there was some master organism from which everything else has evolved using grandparent to parent to child inheritance. At various points in this inheritance chain variation has occurred by genetic mutation which has given rise to a variety of species.

Perhaps this is a good point to introduce the idea of evolutionary strategies. Prokaryotes have adopted what appears to be a shotgun approach. They multiply rapidly, make little effort to clean up errors in the DNA of the offspring, just hoping that by the laws of statistics some of the next generation get through to reproduce. That means that they can evolve rapidly but at the cost of many unviable individuals. Eukaryotes are more complex. Their rate of reproduction is generally lower. This could be because they have complex mechanisms for checking and correcting DNA errors. The eukaryote strategy is one of getting it right as far as possible. This results in a lower level of mutations making it into offspring.

EXCEPTIONS TO THE RULE

There are two major exceptions to this rule which have been discovered in recent years. Firstly, around 2000 million years ago eukaryotic cells developed from simpler cells. This was not a result of evolution by gradual genetic mutation but by the wholesale engulfing and incorporation of other organisms (and thereby their genetic material) by a process called endosymbiosis. This process may have occurred several times in history. It will not be discussed here as I have recently considered it in more detail elsewhere (Gamble, 2008). It is important to differentiate the endosymbiosis which lead to the evolution of eukaryotic cells (i.e. the total merging of the two parent organisms) from the endosymbiosis seen today in many insect species where specific bacteria live inside the host insect's cells. These insects frequently have diets poor in certain nutrients and the endosymbiotic bacteria are able to supply the missing components, such as essential amino acids. Both the insect and the bacteria can live without the other, they have completely independent genomes and each can evolve independently, but it is to their advantage to work together (Reynolds and Rolff, 2008; Futuyama 2005).

Interestingly, as endosymbioant bacteria live inside a very controlled environment, the inside of another cell, they too do not experience normal evolutionary pressures. Over time their own genome might start to degenerate and they come to rely upon the host cell to support them (Feldhaar and Gross, 2009),

The second phenomenon which needs to be considered is the role of Horizontal transmission of genes. This is most widely known about in the transfer of antibiotic resistance between different bacteria. Bacteria may have one or more small circular pieces of DNA other than their main genetic material. These are called Plasmids and are not essential to form a viable cell. The plasmids carry additional genes, which may include antibiotic resistance genes, and are freely exchangeable with other bacteria. Therefore these genes are not subject to the normal evolutionary mechanisms. In a way this harks back to an early view of evolution by Lamarck (Gribbin, 2002) which works on that basis that organisms acquire characteristics during their lifetime which they pass on to their offspring. If a virus invades a cell, providing it does not kill the cell it too may end up leaving fragments of its DNA embedded in the host cell genome.

MISSING LINKS

An important stage in the understanding of evolution was Gregor Mendel's work in the 1860s on the genetics of peas. Although Mendel did not understand the mechanics of how genes worked he developed the concept of a gene as carrying all the information about a characteristic. The inference must be that if evolution occurs because of selection of advantageous characteristics over others then evolution must involve genes.

Key points in understanding the mechanisms of evolution were the discoveries of DNA as the material from which genes are made and later its structure and function. DNA was discovered by Friedrich Miescher in 1869 (Hartl and Jones, 2002), but is not until Oswald Avery's experiments in 1944 that it was shown to be the genetic material (Wilkins, 2003).

McElheny (2003) states that Darwin's work had a great influence on the young James Watson. When Watson and Crick proposed the double helix structure for DNA (Watson and Crick, 1953a) Watson is reported to have equated this in importance to science as Darwin's Theory of Evolution (McElheny, 2003). He was probably correct in this view.

The more important part of the Watson and Crick (1953a) paper was not the beautiful helical structure of DNA but that it described a method of reproducing DNA. Watson and Crick (1953a, 1953b) describe DNA as the carrier of the genetic information and therefore the genes. They describe how one strand of DNA can be duplicated to produce a new strand by pairing free nucleotides against the template strand. By showing how genes work at the molecular level they are also showing how evolution could work at the molecular level.

The description of the DNA duplication method also shows possible mechanisms by which mutation could occur such as insertion of one or more bases, deletion of one or more bases or possibly substitution. Until this point evolution was thought of as a gradual process, but here we have bases that can be either added, taken away or substituted, or not. This was a change from a continuous to a step-wise process. In researching this paper I came across a quote that the discovery of DNA structure was the point where evolution became digital as opposed to the previous analogue method of change.

The key parts of the evolutionary story, the Origin of Species (1859), Mendel's discovery of genes (1865) and Miescher's discovery of DNA (1869) all occurred within a ten year window, but it took almost exactly 100 years more to understand how they all worked together.

DISCUSSION

A key point of The Theory was that a characteristic once lost was not reinvented. Darwin used this to explain why creatures found in the fossil record do not correspond to creatures seen today. Watson and Crick's model gave a potential answer for this. Once a mutation occurred it was unlikely that another mutation would occur at exactly the same place and if it did, it is unlikely that the new mutation would exactly reverse the first mutation.

Futuyma states that among the principles put forward by Darwin is that evolution is gradual. Indeed Darwin himself (quoted by Vendetti and Pagel, 2008) states "As natural selection acts solely by accumulating slight, successive, favourable variations, it can produce no great or sudden modifications; it can act only by short and slow steps". However, in 1972 Niles Elderedge and Stephen Jay Gould (Vendetti and Pagel, 2008) put forward the Theory of Punctuated Equalibrium, which basically states that evolution moves forward in leaps where many evolutionary changes take place closely together when a new species diverges from existing species. There are quieter periods with less evolutionary changes between these speciation events. Although some may have catastrophic effect on an individual, most single mutations will have little or no obvious effect on the organism. For the divergence of the stream of life into two species there must reached a point where a critical mutation takes place, for example in a regulatory protein. It is this change in regulation which brings previous mutations into play.

At the time The Theory was written plants and animals were classified into family groups by looking at their taxonomy. Organisms with similar characteristics were grouped together as probably having common ancestors.

The development of modern genetics and the ability to sequence the genome of organisms has allowed more evolutionary information to be gained and using bioinformatics tools molecular phylogenetic trees can be constructed which show the likely evolution of organisms (Gamble, 2007). Whilst some of the old classifications have held up well to modern molecular scrutiny other taxa have not. But what molecular phylogeny can do is trace very well the evolution of one organism from another. This provides evidence to support as Haldane and Huxley (1927) describe "within a species there are a number of parallel streams of living substance flowing through the generations; but these parallel streams may diverge, and the original species branch into two".

If The Theory is correct it should be possible to trace back through all the molecular data which is now being collected to find out what the original common ancestor was like. It is possible to trace some ancestors back over relatively short periods by sequencing the genomes of and organism and looking at mutations in genes. The most productive of genes to examine are those involved in protein synthesis (Whitfield, 2004) as this is a fundamental process to all living organisms. There are about 60 genes that have been identified involved in this, although (Whitfield, 2004) it is estimated that a minimum of 600 genes would be required for a viable organism.

Whitfield quotes evolutionary biologist Carl Woese (the discoverer of the archeobacteria) as saying that he sees the primordial oceans as being a sea of cells which freely exchanged material. This is very much like the horizontal transfer of genetic characters seen in modern bacteria (as described above). If the creation of eukaryotic cells by endosymbiosis is also taken into consideration, this explains why it has been so difficult to understand what the original cells looked like.

That is even before consideration is given to the debris of old viruses left in the genome has been considered. Perhaps viruses provide a route for the horizontal transfer of genes in higher organisms. They have been used in gene therapy to transfer in repair genes. Do they transfer genes between species naturally? If so, this is the old Lamarck idea of passing down acquired characteristics again.

The Theory was based on the study of complex multi-cellular eukaryotic organisms. Simple prokaryotic organisms numerically make up around 90% of life on Earth. The remaining 10% are eukaryotic organisms of which around 99% are single celled. Therefore The Theory was built upon looking at a subset of the 0.1% of life which is multi-cellular. It is remarkable that it works at all. The areas where The Theory starts to break down are amongst the prokaryotes and the single celled eukaryotes, which were not part of the original evidence used to construct The Theory.

There is much recent research examining the possibility of life on other planets, for example Stephen Baxter, Robert Elphick and I (2006) have proposed drilling the northern ice cap of Mars to search for signs of life and to collect climatic data. If such life is found it would be interesting to confirm that it obeyed evolutionary rules.

CONCLUSION

The modern evidence of molecular genetics provides mechanisms which can explain well the mechanics of how evolution works.

Isaac Newton first published his Laws of Motion in 1687. At the time they described motion adequately. In the early 1900s along came Einstein with his much more complex but more accurate Theory of Relativity to describe motion. Einstein's theory is, itself, acknowledged by many as still being an approximation, albeit a better approximation than Newton's. For most practical purposes Newton's Laws are still used.

So it is with the Theory of Evolution. It is a very good approximation to how different species arise and in most cases it is still adequate. It breaks down in some of the fine detail, and perhaps there is room for an updated theory.

The overall conclusion is that the basic parts of the Theory of Evolution do hold up to the modern evidence and that the modern evidence largely supports the Theory of Evolution. Perhaps, like life itself, the theory has started from simple origins and has evolved into something more complex.

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Glass: Not So Brittle After All

John Plummer

Ask any primary school child to comment on the properties of a glass as compared to those of a metal and the answers would not be dissimilar to those a professor of Materials Science would make if posed the same task. Certainly the extent of description may vary, but the answers would condense down to the same themes; glass is weak, brittle and transparent whilst metals are strong, ductile and opaque. We can see therefore that glass and metal are as different as chalk and cheese, and for this reason have never competed for use in applications. However, it would be wrong to assume that metals are superiour to glasses in load bearing situations; a novel and emerging technology combines the chemical content of metals with the random, amorphous atomic structure of glasses. The result is a unique group of materials that are capable of mechanically outperforming well established traditional metallic alloys, such as steel and titanium. As such, these so called "metallic glasses" or "amorphous alloys" attract huge attention from the worldwide academic community and now represent a viable and lucrative business opportunity for the investor.

Production Principal and Techniques

Cooling a molten metal results in a change in the arrangement of atoms from a random (amorphous) array to a uniform crystal structure. Solidification of a glass does not see such a formation of a crystalline structure however and instead the molten amorphous array of atoms is stable at room temperature. The reason for this is related to the ability of the atoms to move around their neighbours during the cooling process. Both materials want to form crystals as this results in the lowest energy state. This is simple for metals due to rapid atomic movement. In glasses though atoms encounter strong forces retarding their movement, preventing them from crystallising. We can therefore see that in order to obtain an amorphous metal we need to extract the heat at a fast enough rate so that there is insufficient time for atoms to arrange themselves into a uniform structure. Indeed, the first metallic glass made in 1959 required the exceptionally high cooling rate of greater than one hundred million degrees per second. This was achieved by a technique termed splat quenching; a copper-silicon alloy was fired at high velocity at a water cooled surface, producing a metallic glass just a tenth of a millimeter thick. Since then metallic glasses have been produced which require cooling rates of just tens of degrees per second and can be made into sections greater than seven centimeters thick. Suction casting represents the most widely implemented method for producing these materials. This involves alloying high purity elements (containing less than 1% of impurities) together in an arc melter, before sucking the molten alloy down into a water cooled copper die. The use of copper as the cooling surface during the production of metallic glasses results from its ability to quickly and efficiently extract heat away from the molten metal.

Improvement in the ability to form metallic glasses over large length scales has come about in part through a greater understanding of which combinations of elements can lower atomic mobility. These guidelines include using alloys composed of at least three elements, with each element having a large size difference to the others. Ideas such as these have produced metallic glasses based on zirconium, iron, magnesium and titanium to name but a few. Crucially, in all cases each alloy is wholly composed of metallic elements.

Commercially available golf clubs featuring a metallic glass head

Mechanical Properties

As earlier mentioned, the mechanical properties of metallic glasses in some cases exceed those of traditional crystalline metallic alloys. Their advantageous as well as deleterious properties can be well highlighted through a case study of one of their early applications.

One of the first commercial success stories for metallic glasses came in the form of golf club heads. Sporting goods have long been an initial testing ground for novel materials as consumers are prepared to pay high market prices, offsetting the high initial production costs. Metallic glasses are well suited to this application as they display very high compressive strengths allowing them to withstand the impacts experienced. Additionally, they are some of the springiest materials currently known, affording added distance to shots. These two properties: compressive strength and springiness are

well in excess of those shown by many highly engineered crystalline alloys. This is a direct result of the replacement of crystals with an amorphous structure. However, there is one property of traditional oxide glasses (e.g. window glass) that they cannot hide from. On deforming a traditional metallic alloy, say a plate of steel, the material will be permanently deformed and loose its shape before it breaks. This permits us to know when a component is close to failure and results in a more controlled break. Metallic glasses however, despite their high strength, do not show such deformation before failure and so break unexpectedly, often into many fragments. This property, inherited from their glassy nature, not only limits the scope of load bearing applications that they can be used in, but also presents a distinct safety issue. A strong research area therefore for academics and industry alike revolves around trying to improve the amount of permanent deformation prior to failure shown by amorphous alloys.

Other advantageous properties, including high hardness, resistance to wear and superiour corrosion resistance, have resulted in further commercial uses including mobile phone cases. Military applications such as amour piercing rounds, where metallic glasses essentially sharpen on impact causing an increase in the ease and depth of penetration, also attracts considerable funding from The Department of Defense in the United States. Additionally, metallic glasses can be easily shaped using processes developed for polymers, such as blow moulding, due to their controlled ability to flow when heated.

Future Outlook

There can be no doubt that metallic glasses offer a unique combination of properties, unmatched by anything currently known. They already represent a realistic business opportunity which can only grow as issues regarding scale of production and deformation before failure are addressed. Their huge potential is demonstrated by the fact that they are one of the most widely researched subjects in metallurgy today.

One thing is certain; we must redefine our conceptions as to what a glass is really capable of.

Acknowledgements

Liquidmetal.com

John Plummer is currently studying for a PHD at Sheffield University and is carrying out research into the development of high strength and fire resistant magnesium alloys for aerospace applications by growing crystals within glassy metals.

Ed

Blow moulded metallic glass at 460°C

Local Exhaust Ventilation

Are your LEV systems up to the job of protecting users adequately?

The COSHH Regulations[1] require employers to prevent or control exposure to hazardous substances by their employees and people affected by their activities. Since inhalation is the most significant route of exposure to hazardous substances, it follows that Local Exhaust Ventilation (LEV) becomes a useful measure to control and capture these substances as they are released into the atmosphere within the workplace.

What is LEV?

LEV is a ventilation system that takes dusts, mists, gases, vapour or fumes out of the air so that the workers or anyone in the workplace cannot breathe them in. An LEV system typically consists of the following components (see figure 1):

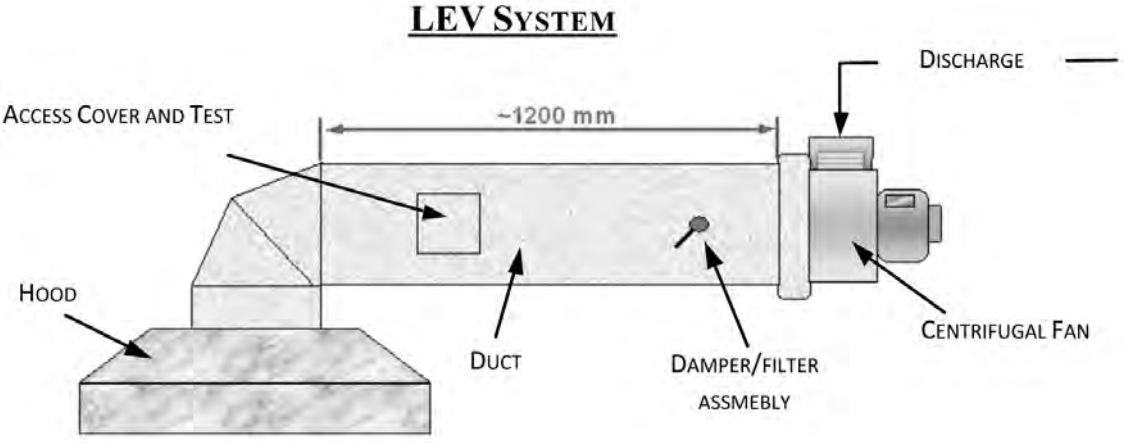


Figure 1

Hood(s) to collect airborne contaminants at, or near, where they are created.

Ducts to carry airborne contaminants away from the process.

Air Cleaner to filter and clean the extracted air

Fan which is of the correct size and type to provide sufficient extraction.

Discharge the safe release of cleaned and extracted air into the atmosphere.

For an LEV system to work effectively, each of these components has to be selected and designed carefully, taking into consideration the work process it is intended to control.

What is the problem?

LEV systems have been used in industry for a number of years and they come in various shapes and sizes. So what is the problem?

LEV can be a very effective way of controlling exposure by removing contaminants from the workplace air, but the HSE says that much of the equipment in use doesn't work. The main problems are:

1. Employers often don't appreciate the extent of exposure risk from their process.
2. Employers and employees are often over-optimistic about LEV capabilities and performance.
3. There has been no guidance on LEV buying and employers are often mislead and mis-sold.
4. As regards the LEV design, often the LEV hood is not matched to the process and sources causing exposure.
5. The LEV system is neither installed nor commissioned thoroughly.
6. The regular checking and maintenance of the LEV systems is often neglected.
7. The thorough examination and test as required under COSHH regulations is often not done or incomplete (it is not "thorough").

Recent statistics from the HSE[2] show that occupational disease and exposure affect many workers. Thousands of people in the UK die of lung disease or get asthma because of airborne contaminants they have breathed in at work. The cost to industry for occupational asthma is £96-135 million and it is on the increase each year. Health risks need to be better controlled and a disease reduction programme is being promoted by the HSE.

What is the Solution?

The HSE has recently published revised guidance on LEV, including booklets for employers, designers, installers and examiners and pocket cards for workers. Following a major re-write, new and improved LEV guidance is now available (see http://www.hse.gov.uk/lev/index.htm) The changes are so significant that the HSE felt the need to provide additional training for their Inspectors and over 400 have been trained and issued with simple test equipment.

As part of a campaign to raise standards, the HSE launched Trainer, Advisor Briefing Days last year. ESL consultants were invited to the first briefing day on 24th October 2008 at the Health & Safety Laboratory in Buxton. The new LEV course training material (presentations, video clips, etc) was given to those attending the briefing, free of charge, subject to terms and conditions. The HSE is doing this because they are looking for a step change in the understanding and application of LEV systems.

In addition to the above, the HSE has published documents[3,4] which should provide employers, managers and health and safety officers with assistance in meeting their legal duties under the Management of Health & Safety at Work and COSHH Regulations[5].

Specialist help

Unless you have a fairly simple process to control, you probably need to get specialist help when it comes to purchasing a new LEV system. There are some third party consultants who will act as advisers but most people will be dealing directly with an LEV supplier. It is therefore important you select and vet any potential suppliers carefully. The following questions might prove useful:

1. What experience do they have in designing and providing LEV?
2. What are their professional qualifications, experience and affiliations?
3. Have they successfully applied LEV to similar processes or activities in your industry?
4. Can they provide references or examples showing successful installation of LEV systems?
5. Are they tied to a particular range of LEV products?
6. How will they show that the LEV provides adequate control?

It is important that you give the supplier a specification of the work that you want to have done and what the proposed system should achieve. One of the areas where specialist help might be needed is the annual examination and test of the LEV systems. What are the requirements of the HSE's revised guidance?

LEV Thorough Examination and Test (HSG 258)

Most LEV systems need a thorough examination and test once each year although COSHH specifies that you are allowed 14 months between tests. This is a legal requirement to ensure that the LEV works well and continues to protect users. Some LEV systems need more frequent thorough examination and testing, e.g. systems that are used to control critical or high hazard processes.

Someone who is "independent" of the maintenance of the system should undertake the thorough examination and test. In practice, this normally means hiring in an outside contractor. Whatever the case, the following summarises what is required in order to carry out thorough examination and test under the new HSG 258:

LEV Examiner

1. The examiner must be competent
2. The examiner must be provided with:
   - Commissioning report
   - User Manual which should cover details of any thorough examination and testing work
   - Log Book recording checks and maintenance activities
   - Full access to the systems and the co-operation of relevant staff
3. If no commissioning report or manual is available, the system will need to be retrospectively commissioned.

Thorough examination and testing of LEV system involves three stages:

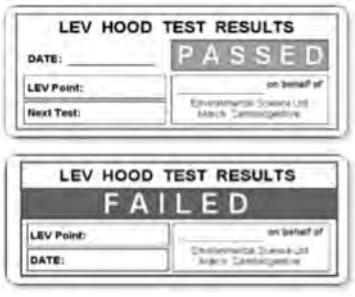
- Step 1: A thorough visual examination to verify "….in efficient working order, in good repair and in a clean condition…." – COSHH Regulation 9(1).
- Step 2: Measuring and examining the technical performance to check conformity with commissioning data
- Step 3: Assessment to check the adequate control of worker exposure

LEV system examiners need equipment such as Pitot tubes, smoke generator, dust lamp, anemometer and sometimes air sampling kit.

LEV Hood Label

This is a new requirement under the HSG 258 that the examiner should attach a test label to each hood when tested and when the LEV requires remedy or repair, the examiner should instead attach a red "FAIL" label to the hood (see figure 2). Employees who use the LEV system and their supervisors need this testing information. All hoods (including fume cupboards) should carry a simple test label.

Figure 2: Test label



Test Reports

The HSE has highlighted some issues for employers with current reports and these are:

1. Report goes to engineering function and join the long queue
2. Report filed and forgotten
3. No action taken

The HSE would like to see the directors and senior managers taking the lead in treating the report as an 'audit' on previous years' checking, maintenance and actions on test results.

A suitable test record should contain the following:

1. Prioritised remedial actions (including any red labels)
2. The process and substance(s) controlled
3. LEV diagram showing location and test points
4. LEV system condition (including photos, serial numbers, etc)
5. Qualitative and quantitative test methods used
6. Qualitative and quantitative test assessment records
7. Required and assessed LEV system performance compared
8. Comments on operator methods of working
9. Comments on system wear and tear
10. Date of next examination and test
11. Signature

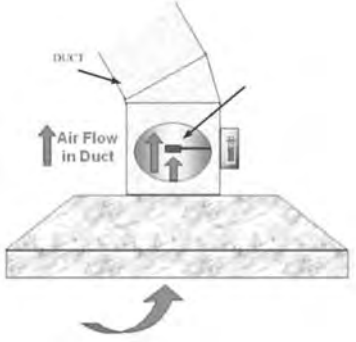
LEV Instrumentation

Quite often, it is difficult to tell whether an LEV system is working properly or not. Hazardous substances are not always visible to the naked eye and nor do they always have an odour.

Users of LEV systems, particularly the operators at LEV hoods, should be able to tell that the hood airflow continues to be adequate to control exposure. Good practice requires the periodic monitoring of performance for all hoods. Generally speaking, new and modern fume cupboards are designed with a complex device to activate an alert if the airflow drops below pre-set trigger levels[6].

The HSG 258 encourages employers to install an airflow indicator at every hood because the operator needs some simple indication that the hood is working properly. It becomes critical when the operator has to adjust a damper to get adequate airflow. The airflow indicator must indicate simply and clearly when the airflow is adequate. A simple manometer can be used and there are other indicators available on the market (see figure 3)

Figure 3: Airflow Indicator



Conclusions

- The new HSG 258 published by the HSE is part of a campaign to raise standards and the HSE will also be taking a tougher line on inspection of LEV systems. Further information on the new publications is available from the HSE website at: www.hse.gov.uk/lev
- If LEV is properly selected, installed, maintained and used, it can be an effective control measure, which reduces personal exposure to hazardous substances.
- The Employer has a legal duty for arranging the thorough examination and test of LEV systems on an annual basis by a competent person.
- The Examiner should issue a simple label for every hood examined and tested.
- The users of LEV systems need to see that the system is working properly and thereby controlling exposure. This can be demonstrated by using a simple airflow indicator on every hood.

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EMU 2009 - Engineering Managers in Universities

Stephen Duffy

Robert Gordon University was the host institution for the 18th Engineering Managers in Universities Annual Conference.

The Conference of Engineering Managers in Universities (EMU) is a loose association of engineering managers in universities throughout the United Kingdom with the following aims:

- To foster a corporate spirit across its membership.
- To enable sharing of best practice.
- To act as a focus for legitimate and common concerns with respect to support to engineering teaching and research in Higher Education Institutions (HEIs).
- To add to individual and corporate knowledge.
- To broaden understanding of the profession from policy directives to implementation of the same.

The term "engineering manager" encompasses a range of employment categories but normally all those who have responsibility for staff and resources in support of engineering teaching and research in a Higher Education Institution. It maintains strong links with the IST.

This annual conference is quite an informal one and it creates an opportunity to bring a broad cross section of university managers together, to enable sharing of best practice and to act as a focus for legitimate and common concerns with respect to supporting engineering teaching and research.

The historic port city of Aberdeen was this year's location; the two and a half day conference was brought together by John Dickson, Technical services co-ordinator in the School of Engineering at Robert Gordon University.

As in previous years there was a strong technical theme running through the content of the presentations and the open discussions, six sessions were delivered over the two and a half days.

The first session immediately got underway as soon as the conference delegates arrived on the first afternoon. Delegates had an opportunity to see the latest research in 3D body scanning; Dr Arthur Stewart, Senior Lecture gave a demonstration of 3D laser, vertical, whole body scanner. Dr Stewart is the deputy director of the Centre

for Obesity Research and Epidemiology (CORE) at RGU and is currently collaborating with health care studies and specialist clothing suppliers. His talk, entitled "Application of 3D Body Scanner in Health", provided the conference with a stimulating start.

Rachel Rennie, Drilling Engineer, Transocean Drilling UK gave an extremely interesting presentation of Post graduate career development with a particular emphasis on Women in Engineering. Rachel was able to share from her personal experience of having to manage technical facilities in a very challenging environment. She is currently in her third year of a five year Applied Drilling Technology International (ADTI) Graduate Development Programme. Her experience covers both on shore and off shore in the North Sea, the later working as part of the deck and drill crews. She progressed to Wellsite Drilling Engineer as part of the ADTI offshore team and oversees specific Wellsite operations.

Other presentations such as "ROV & AUV Technology" by Ken Bryson of SUBSEA 7, "Helicopter Engineers" by Paul Richardson of Bristow Helicopters, and "Alternative Energy" by Jeremy Cresswell of Aberdeen Renewable Energy Group looked at the many technical service and suppliers to the oil and gas industry based on and offshore around Aberdeen. These sessions triggered many discussions and stimulated ideas.

Professor John Watson, Dean of Faculty of Design and Technology gave a revealing insight into the relationship between Robert Gordon University and the Oil industry, explaining the innovative approach the University has established in attracting academic excellence and also the new challenges RGU face with respect to distance learning and technical support.

The EMU conferences have always been an excellent forum for building relationships and developing good practice with colleague managers and supervisors. It promotes an invaluable professional network and this year's conference was no exception, with many opportunities to discuss today's changing support issues and comparing how these are being approached. This year's conference also attracted new delegates representing both Lancaster and Portsmouth Universities.

Engineering in Universities will continue to face challenges particularly in the present financial climate. But we look forward to facing these challenges head on with the help of EMU, which continues to grow, adapt and develop, by offering a valuable resource to existing and to up and coming technical managers.

If you have responsibilities for technical staff and/or facilities in a UK University, you can receive details from EMU by contacting Stephen Duffy, EMU secretary.

The 2010 EMU conference will be held on 24th – 26th March 2010 and will be hosted by Oxford University.

Look for the updates on the EMU web site http://www.emu-hei.co.uk

or contact: Stephen Duffy EMU Secretary, Stephen.duffy@manchester.ac.uk

UK Higher Education
Engineering Managers in Universities

The Development of Surgical Training and Technology in the Twentieth Century in the UK, Europe and North America.

Surgical Workshops and Surgical Training
The Technical Input

J.E. Ramcharan

Introduction

Before, during, and after World War 2, and before the NHS was started, medicine and surgery were practised as a last resort and in emergencies only. Preventative medicine and private medicine were practised. Secondary care (hospitalisation) was carried out by private doctors and surgeons. For those who could not afford this, some charitable bodies, including religious groups, ran hospitals in the UK and in the British Empire.

After the NHS was set up, there was a drive to build more hospitals and improve the medical care of patients in the UK. The twentieth century saw a great improvement in the NHS and good health was seen as the absence of illness. Medical technology moved forward but surgical technology was mainly, although not totally, dealt with by junior surgeons, nurses and other clinical professionals. After the Flowers report in the 1980s, there was a restructuring of hospital services which affected teaching hospitals and medical school services especially in London. From a Marxist viewpoint, this reorganisation was about saving money, since the NHS was, and still is, free at the point of delivery and the cost of the NHS was rising to much higher levels. However the main reasons for this rise in cost were the introduction of new technologies, a raised awareness of good health and thus higher expectations from patients, also a substantial increase in the population of the elderly and a greater life expectancy. Towards the end of the twentieth century, a different view of health was emerging and a more holistic view was being taken i.e. health was no longer seen as an absence of illness, but with the ability to cope with everyday chores and problems, also a move to a better quality of life was being sought.

This paper is one of three, being prepared and looks mainly at the change of surgical education after the Calman Report. Calman claimed that a greater emphasis should be put on the practical aspect of training for Surgeons and should be part of surgical education for Surgeons. Less lecturing, especially in Basic Medical Sciences was needed.

Career Background

My own background was starting work in 1957 as a Path Lab Technologist in Georgetown, British Guiana, then in 1961 at the 'old' Charing Cross HMS in Charing Cross in the Department of Pharmacology. The Advanced Diploma in Physiology and Pharmacology was successfully completed. This course was run by the Paddington Technical College (now the University of Westminster) and the Institute of Science Technology. Physiology was organised by Charlie Evans (DCL) and Pharmacology by Ken Didcock (St. Bartolomew's HMS), In 1966, I left the Charing Cross HMS and joined the Royal College of Surgeons (RCS) as Senior 1 Technician in charge of the Neurological Unit in the Dept. of Physiology. After 5 years and an FIScT thesis on the knee joint, I became Chief Technician of the Dept. of Applied Physiology and Surgical Sciences. In the 1970s under Professor David Slome we ran the first ever surgical workshop and this was in microsurgery. Professor David Slome and Mr. Owen, an Australian neuro-surgeon, ran the workshop. The workshop was performed on live rats and the technical

input was for the chief technician to anaesthetise the rats with the help of the senior animal technician (Peter Naylor), who also shaved the animal in preparation for surgery. Setting up and liaising with the supporting companies too was left to the technical staff with help from the late Brian Eaton, FIScT. The original approach and agreement for support was made by Professor Slome. Operating microscopes were on loan from Carl Zeiss for the weekend. The technical staff had to set these up ready to be used and micro-sutures were given by Ethicon Ltd. (Johnson and Johnson). This was a time when I learnt from the likes of Dave Moore and Owen Rowland how to be 'a good beggar' I had formed a good relationship with the Johnson and Johnson group and other companies some of whom were present at my retirement in 2000. Professor Bevan from Birmingham came soon after to discuss the running of what was to be the first Anastomosis workshop with Professor David Taylor (Slome's successor). Taylor was from the University of Edinburgh.

Although the Royal College of Surgeons helped to retrain surgeons after the war, some subjects taught were in 'Basic Medical Sciences', there was also research into basic medical sciences in the way that all medical schools did. The subjects included were Anatomy, Physiology, and Pathology with the then affiliated subjects of Biochemistry and Pharmacology. Lord Flowers from Imperial College in London wrote a report claiming that the FRCS was a diploma and not an academic degree. University funding to the Royal College therefore should be terminated. The British Postgraduate Medical Foundation therefore had no alternative but the gradual withdrawal of funding since they themselves were being reviewed. The reorganisation of Medical Schools and teaching hospitals in London were being reviewed. The conservative government under Margaret Thatcher was instrumental in this reorganisation, which affected all London teaching hospitals and medical schools. As this came with streamlining of staffing many jobs were lost including technical jobs. There were new jobs created too for technical staff who were willing to change and adapt. I was one such person and after becoming a senior manager, for five years, I was appointed to the Department of Surgical Education as Technical Services Manager. I had done research in physiology, rheology (study of the physical factors of blood) and surgery and had written some twenty papers both technical and academic. I had worked as a technician before the Flowers report then I became Laboratory manager in the new Hunterian Institute and a senior manager in the RCS. The Hunterian Institute became the new research and teaching arm at the Royal College of Surgeons and was chaired by the late Sir Gordon Robson, who was my immediate boss and line manager. I had built up departments, some of which I subsequently had to close and start new research departments (Medical Physics, the Dental Research Unit). After these were transferred to the London Hospital, King's College London and the Institute of Child Health, I was appointed Technical Services Manager to the new Department of Surgical Education in 1992 and was to organise the teaching of surgical workshops. I had worked hard as a senior manager taking over old Basic Medical Sciences departments and eventually closing these old research departments, starting new ones and then at the same time organising surgical workshops in the Dept. of Education. At one stage I was asked to temporarily also do the general organisation of all workshops, as the new managers/administrators were not yet in place. I started taking workshops too all over the UK and also overseas as well. I had to do what is today called practising multi-skills. Health and Safety, Finance, Ethics, purchasing, help with grant applications, building and estates, and for a brief period covering the HR department. In 1999 I had become very tired and decide to retire', since I was also 60 years of age. In recognition of my work I was granted a sabbatical/study leave. My sabbatical was funded by the Royal College of Surgeons, Ethicon (Johnson and Johnson) and one trip by AutoSutures, UK.

Note only. *After eight months of retirement, I was appointed non-executive director to the Redbridge Primary Care Trust. I left in 2003 and joined Cambridge University to study Primary and Community Care for a Masters degree. Because of illness and a serious accident I withdrew from Cambridge and finished off my thesis in London. I graduated in 2008 with an MSc in Health Promotion.*

The rest of this paper will report on that sabbatical and how surgical training was done in Europe and the USA towards the end of the twentieth century. The development of further surgical workshops will form the second paper of this series. It was important to look at how medicine has changed to understand how training and the role played by technical staff had changed. It also shows development of technical careers by continuing education.

Countries visited and the Courses

Germany - Hamburg (European Surgical Institute) ESI Course - AES GBI (Association of Endoscopic Surgeons of Great Britain and Ireland) Laparoscopic Colo-Rectal surgery

There were eight people who left from London Heathrow and eight from Manchester. Ten surgeons attended the course from Britain and two Tutors - Professor Guillou from St. James', Leeds and Mr. Stuart Gould from St Mary's in London. The rest were support staff which included Brian Tobin (Ethicon, Johnson and Johnson), Jo Harrison (Keymed), and me. A welcoming address was given by Brian Tobin Introductory talks were given by Jo Harrison and Kirstin Engel (ESI). Prof. Guillou and Stuart Gould lectured on training aspects, low anterior resection and abdomino¬ perineal resection. Before lunch, lectures were given on ileocolectomy for colon disease, rectopexy, and reversal of Hartman's and transanalendoscopic microsurgery. After lunch a lecture was given on laparoscopic surgery for colon cancer. The practical session in the dry laboratory started and the techniques practised were skeletonisation exercises, sewing and clipping techniques, extra and intra corporeal suturing techniques and end to end anastomosis.

United States of America - Cincinnati Ethicon Endosurgery Institute (ESI)

I left Heathrow on Easter Saturday bound for New York. Having spent the Easter weekend with my sister, her husband and my nephew, I left LaGuardia airport for Cincinnati. I met Brian Tobin (Professional Education Manager, Ethicon) and we both went to register at the Omni Hotel for our stay. After breakfast the next day, we left for the Endo-Surgery Institute in Cincinnati. Tammy Leitsinger, Professional Education Specialist, who was our official host for the period met us.

After coffee and an introductory talk, we next met with Brian Zint (Course Team Leader), Judy Faeth (Institute Department of Education Administrator), and Doris Purcell (Professional Education Overview Team Leader). We then toured the entire institute and the site next door where we saw endoscopic instruments being assembled. Lunch followed with Ed Standen (Director Professional Education).

The following day we met with the two main academics, Professor Aaron Ruhalter and Dr. Effrain Miranda. On that day Prof. Ruhalter showed us around the animal facilities and the operating theatre suites. Courses were run in the wet areas (operating theatres) and lectures were given by the two academics on:-

Thoracic pneumonectomy-wedge resection-(anatomy steps of procedures)

Laparoscopic Cholecystectomy

Upper GI and Lower GI tracts

Professor Ruhalter works closely with the University of Cincinnati on several courses which include laparoscopic bowel and colon/rectal surgery, advanced endoscopic and gynaecological surgery, laparoscopic cholecystectomy, alternative techniques for the hysterectomy and myomectomy surgery, laparoscopic abdominal solid organ surgery (splenectomy, adrenalectomy, pancreatectomy, and liver resections). Minimally invasive cardiovascular surgery, videoscopic anterior approaches to thoracic and lumbar spine surgery and minimally invasive solutions for today and tomorrow.

USA - New York - Winthrop University Hospital and State University of New York
Professor Roger Dee

I visited New York and met with Professor Roger Dee formerly of Middlesex Hospital and a PhD student at the RCS in the Neurological Unit (I960s). I worked with Prof. Dee when he studied the intrinsic and extrinsic innervation of the hip joint. I myself did a project on the knee joint, which was an extension of Michael Freeman's work (London Hospital). Freeman did the passive movement experiments of the knee joint and my thesis for the fellowship of the IST was "An Electromyographic Study of the Reflex Effect of Electrical Stimulation of the Articular Nerves in the Knee Joint".

Dee was by this time professor of orthopaedic surgery at the Stonybrook School of Medicine at the State University of New York and also chairman of the department of orthopaedics at the Winthrop University Hospital also in New York. We discussed the old days and the then new MRCS exams and the new Basic Surgical Skills course having an orthopaedic content and the relevance to senior house officers in training in the UK. Roger Dee was trained in the UK in the early 1960s.

On the flight back to London, I reflected on what I call the 'American Experience' and thought of all of the funds invested in healthcare and surgical training in the United States. I assumed that other areas in medicine and training-surgical and medical were similarly funded. I know of the ATLS programme, which originated in the USA and of the cardiac resuscitation training in Seattle. With the late Brigadier Haywood, then Colonel, we ran the first ATLS (Advanced Trauma and Life Support) course at the Royal College of Surgeons for surgeons including those from the RAMC. Colonel Ryan (now Brigadier Ryan) and I ran this course at Milbank before Milbank was closed. The use of the 'fool proof' defibrillator in all working areas is now seen in the UK. The British Heart Foundation in the UK should be congratulated in taking the lead in the use of the automatic defibrillator in the UK workplace.

France - Paris - (Elancourt) Autosuture European Continuing Education Centre
Course-Laparoscopic Cholecystectomy.

In mid May I departed from London for a visit to Paris. After a brief tour of Paris itself, I proceeded to Montigny le Bretonneux, where I stayed at my brother's home. Montigny is near Versailles and not far from Elancourt where I visited the Autosuture (Europe) Continuing Education Centre. After a brief welcome by Jean Francois Mozet, the Senior Sales Director I was taken on a tour of the facilities, which were similar to that in Hamburg. The laparoscopic cholecystectomy course was for young French surgeons. After the course I had a meeting with Monsieur Mozet relating to the possibility of holding workshops jointly with the RCS in London.

Discussion and Conclusion

In Hamburg, Dr. Med. Jurgen Brenner, Director of the Institute, had showed us around. There were lecture theatres with NV rooms adjoining for live transmissions from operating theatres in hospitals around the world. The administrators were on the ground floor as was a coffee room and away from the operating suites. The operating areas were impressive and better than many human operating theatres I have seen in my time. The operating suite had clean 'scrub' areas and preparation and storage areas were well kept ¬very clean, tidy and well organised. The whole infrastructure supporting the courses was impressive and a lot of thought was given in planning and building these areas. The staff at the ESI comprised surgeons, technical staff and veterinarians who all worked closely together to put on the 'show'. Administrators were

mainly concerned with the drawing up of programmes, marketing the courses, getting tutors in and general organisation, but did not interfere with surgical and technical organisation. The Surgical, technical, managerial and veterinary staff all worked together and provided successful courses. In Cincinnati, where Ed. Standen, Director of Professional Education showed us around, the operating suites and AJV facilities were excellent and in large spaces. These areas were well equipped too and one could only dream of the amount of funding that went into these facilities. Again the administrators and the eating areas were kept well away from the operating areas. The animal staff were caring and the animals were given excellent treatment. One technician had won medals and showed certificates for her work on caring and for animals. The unit was the best I had ever seen. The cleaning staff were willing to work at anytime of the day including evenings and early mornings and they did a good job. One thing that impressed me a lot was if a surgeon were asked a technical question that surgeon would not 'bluff' but said that he didn't know and directed the enquirer to the relevant staff who did know. All staff practised this policy.

Simulators / Models

During the twentieth century there were four types of models used in surgical training in the UK, Europe, North America and the Middle East.

a) Human cadaveric material preserved and prepared by technical staff.

b) Live animals supplied by abattoirs to recognised technical staff only.

c) Models of animal tissues and organs prepared by technical staff.

d) Models of synthetic simulated material designed by surgeons and prepared by technical staff originally, and computer modelling-cooperative development by surgeons, computer experts and technical staff.

Towards the end of the twentieth century and after the days of heart and kidney transplant research, more thought was given to the use of synthetic models instead of animal tissue/organs for training. The arrival of, and development of the simulated model was becoming more popular. Computer modelling became popular too with younger surgeons and with the development of techniques for laparoscopic (keyhole) surgery and robotic surgery. An example of such a young surgeon is Lord Darzi, now junior Minister of Health.

In my view there are advantages and disadvantages of all of these models. Live animals tend to be popular with both students and tutors. The argument varies and an example of the disadvantages is the view on haemostasis, which does not exist in simulated material. However there are strict government regulations governing the use of live animals in America and Europe, whilst the use of live animals for training in the UK is banned with the exception of training in microsurgery where live rats may be used. There are financial implications too, like staff cost for veterinary staff and care unit technical staff. On the ethical and moral side, some do not believe that animals should be used for research, training/education. The change from the old Cruelty to Animals Act of 1840 to the more modern Scientific Procedures Act of the late twentieth century meant less use of animals.

Synthetic models are sometimes not very well made, and if they are well made they tend to be very expensive. In my experience neither surgeons in training nor surgical tutors like synthetic material very much, however it does satisfy those looking for alternatives to animal tissue. The best compromise is using animal tissues in 'Jigs' or simulators. The cost is moderate and carcasses are used in the meat trade for making certain pet animal foods and the animal rights groups seem to accept this. The department of Agriculture, Foods and Fisheries in the UK then brought in stringent rules governing the use of animal material from abattoirs. The main reason for these regulations lies in the attempt to bring more control on the spread of pathogens like BSE to animals and humans as some animal pathogens may also be human pathogens and thus harmful to the human race. This debate goes back to the 1800s and in 2009, on the 200th armiversary of the birth of Charles Darwin, Ben Macintyre wrote in a Times supplement on Charles Darwin, claiming that although Darwin loved animals and all things natural, he did not oppose vivisection. Macintyre also produced a copy of a letter from Darwin to Professor Holmgren of Upsala supporting the use of animals for research in Physiology (Times, 12th Feb. 2009). The debate continues into the twenty first century and staffing attitudes and discipline are not very different to those in the twentieth century in the UK, Europe and North America.

J.E. Ramcharan, MSc, FIScT, FRSH, MBIM

Retired Royal College of Surgeons of England and Redbridge Primary Care Trust.

Book Review
From Fuggles to Firkin

By Charles Frederick Hyde and Susan Fredericka Hyde

Reviewed by Alan Gall

For anyone interested in the technology and history of beer making, *From Fuggles to Firkin* will provide a first-hand account of everyday life as seen through the eyes of a Victorian brewer. Charles Frederick Hyde recorded details of his daily toil in a series of diaries as he worked his way up the employment ladder to become head brewer at one of Manchester's largest concerns – Chesters Brewery Co Ltd.

Author Sue Hyde has transcribed her grandfather's diaries for the years 1890-1899 (the diaries for 1889, 1891 and 1897 are missing) with notes about the people and places mentioned. There are also 70 illustrations to back up the text.

Charles Hyde, or CFH for short, began his career as an apprentice to William Tong at the Diamond Brewery, Bolton. He then moved to the Wellington Brewery in Manchester where he found two hundred barrels of 'sour' beer that he managed to re-process and sell, although it took him two years! His employer at the Wellington was a local Councillor called John Battersby and when Battersby sold out to Chesters in 1888, CFH joined the new owners 'on trial'. Thirty odd years later he was responsible for the recipe that gave the company its most famous product – Chesters Best Mild, know locally as 'fighting mild'.

John Battersby died before his time with what the newspapers of 1891 called '…that mysterious scourge called influenza'. Perhaps this helped to enhance CFH's existing hypochondria: 'Bad cold Influenza commenced to take quinine' (12 September 1892) and '…don't feel up to much after this cow pox vaccination.' (2 March 1893)

As Sue Hyde points out, Charles Hyde's bosses at Chesters were an ungrateful lot. They sometimes insisted on buying cheap materials, against CFH's advice, then complained when the beer wasn't up to standard. On top of disagreements with his superiors, he sometimes had to wait many weeks for his wages.

As CFH's career progressed, he became less tolerant of others and ever more confrontational. This attitude had its perils. On 14 May 1893: 'Mr Frank Ravanagh met me, struck me in the mouth and I returned the compliments'. It's interesting to note the 'little farts' are not a new phenomena and existed over a hundred years ago (CFH's scathing reference to one of the brewery's suppliers). Relations with his own family were also less than cordial – two of his sons ran away from home, although they did eventually return.

An application in 1893 for the job of brewery manager was turned down and a new man, William Cahill, brought in over his head. Not surprisingly, CFH resented this appointment: '… Mr Cahill who hangs like the devil over my life ' (20 September 1894). Despite his long service with Chesters as head brewer, CFH never made it to board level, something that always rankled.

On the technical front, we learn that CFH used the Kjeldahl method (for nitrogen determination) and bought laboratory apparatus from the supplier J.J.Griffin & Co.

He seems to have had a particular interest in studying yeast, writing one or more papers in collaboration with a colleague, Dr Alexander Miller. He often went on visits to other breweries to see how they operated, and received visitors in return.

I have to declare a prior interest in this book. Several years ago I was sent a copy of the transcription for checking and am delighted that it has finally made it into print.

(NB Fuggles = a variety of the hop plant; Firkin = 9 gallon cask).

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T14406	Mr.E Alorsey	MIScT
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Membership No	Members Name	Grade
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1 IN TOTAL		

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Probably, Not!

Alan Gall

The mathematics of probability can be totally counter-intuitive and the following story gives an example of how easy it is to be fooled with figures.

Haemospondulosis (HS) is an incurable disease that shows no symptoms until it suddenly causes the arteries to rapidly expand and explode. Although it is quite rare, a dedicated hypochondriac becomes convinced that he has contracted the illness. He decides to risk exposure to all the other potentially harmful bugs by consulting a GP at the local surgery.

The doctor assures the patient that only 1 person in 100,000 of the population (0.001%) ever gets this gruesome condition. He, personally, has never seen a single case. None of his colleagues at the medical centre have ever seen a single case. The man is relieved to hear these encouraging statistics but insists on having a blood test anyway, just to be sure. A week later, to his horror, the result is positive and panic sets in. Perhaps the testing procedure has yet to be perfected? Perhaps a second blood sample should be sent?

But when questioned about the possibility of a mistake, the doctor says that, sorry, the diagnosis is almost certain to be correct. In fact, the test has been proved in extensive trials to be 99.9% reliable, a miracle of modern science. The man turns pale when confronted with such shockingly heavy odds against the likelihood of error. Should he abandon all hope?

...See next page

Answer

No, because his chance of actually having Haemospondulosis is less than 1%.

Why?

This can be illustrated with some numbers. Assume that the world's population is one hundred million. Out of this, there will be 1000 people with HS (1 in every 100,000) and 99,999,000 who are otherwise healthy. Now, if the test is 99.9% reliable then it is 0.1% unreliable and one person, out of the 1000 who have the ailment, would test falsely negative, leaving 999 positive tests. Out of the 99,999,000 individuals who do not have HS, the test would give 0.001 x 99999000 = 99999 false positives. So if the whole population were to be tested, a total of 999 + 99999 = 100998 positive results for HS would be obtained.

Now, since our man must be one of the 100998 people who belong to the 'positive test' group, and there are only one thousand persons in the entire population who are infected, his probability of having HS is

$$100 \times \frac{1000}{100998}$$

= 0.99%

Good news indeed and just to put the reader's mind at rest, HS can now be successfully treated with well-seasoned chicken soup.

Institute Merchandise

We do have plans to introduce additions to our corporate merchandise over the next few months but for now we just have ties available. These are smart and modern, navy blue and are of a high quality. Please contact the IST office.

New Style Blue Ties £10.00 + postage

Reverse of cover page.

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Kingfisher House
90 Rockingham Street
Sheffield
S1 4EB

Tel: 0114 276 3197

office@istonline.org.uk

www.istonline.org.uk