The Institute of Science & Technology

The Journal

Summer 2010

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Reverse of cover page.

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CONTENTS – SUMMER 2010

Cover spider photograph by Steve Pownall of Eccles

Editorial

Welcome

Welcome to the summer 2010 full colour edition of the IST Journal!

My thanks to all of this issue's authors for their very interesting articles and for also providing some stunning images. It's made for a very good looking publication in my opinion.

What's happened in the world of science and technology since the start of 2010? Well we had a very welcome announcement at the beginning of April by the Department for Business, Innovation and Skills to say that they were about to appoint a "New champion for skilled technicians".

It was said by the then Labour government that the new Council will support the commitment to create a new technician class in sectors like engineering, scientific research and manufacturing, outlined in the Skills for Growth paper last year. I guess we are yet to see how, or even if, the new coalition government will commit to fully take this forward; but nevertheless, it was great news for our technical/technologist community and something that IST and HEaTED will aim to be heavily involved with. *(See John Robinson's chairman's report in this issue for details.)*

On a diverse and wildly different subject, I read in the news just after the new government was formed of some interesting research results. The research showed that, surprisingly, lamb curry ready-made meals eaten in the UK amount to an annual carbon footprint equivalent to 5,500 car trips around the world or 140 million car miles!

The estimates, by researchers at the University of Manchester, are based on the figure of 30% of adults in the UK who eat ready-made meals at least once a week. It seems that curry, as one of the nation's favourites, accounts for up to 10% of ready-made sales – which, not surprisingly, have soared during the recession.

Evidently, this fast food meal generates the equivalent of 4·3 kg of carbon dioxide emissions per person, with the meal's ingredients responsible for 65% of the carbon footprint, and the lamb contributing half of the total. The meal manufacture contributes on average 14% and packaging 4% of the total carbon footprint. The contribution of transport is only small at 2%, but surprisingly storage at the retailer contributes 16%.

It appears that even a Christmas turkey meal prepared at home is a far greener offering, coming in at only 2·5 kg of carbon dioxide emissions per person. One of the reasons for this, they say, is that preparing food at home can help to reduce the carbon footprint. The same lamb curry if prepared at home has a 20% lower carbon footprint, mainly because of the elimination of the refrigeration stage at the retailer needed for chilling ready-made meals.

I guess this is proof of something that I have always suspected, that eating curry leads to high emissions, and hot curry is only 'cool' if it's not been chilled!

Ian Moulson
Editor

And finally, even though we at Sheffield are exploring all previously untapped possibilities for new student recruitment, I had assumed that we stopped short of non human!

The Valery Chapman Award

Philippa Nobbs ▶

This Award was introduced to recognise and honour the significant contribution made by the late Valery Chapman to the working life of school and college laboratory technicians by starting the Science Technicians' Discussion List, SCITECH-L, a service hosted by the University of Central Lancashire.

This year's Award goes to Hilary Wright, a technician at The Maynard School for Girls in Exeter to enable her to attend a one-day course on microscope maintenance, run by CLEAPSS® (http://www.cleapss.org.uk).

Applications will be sought, from members of the SCITECH-L mailing list, from September, for next year's Award.

For more information about SCITECH-L, go to the website http://www.sciencetechnician.com

Chairman's View

John Robinson

May 2010

This year's annual report is flavoured by a variety of influences, not least of which is the recession, which is likely to result in difficulties wherever we work, public sector workers will feel the cuts whichever political party is successful at the election. Private sector workers will have already experienced their equivalent, falling sales and income resulting in pay cuts or redundancies. Very few of us will escape hardship in one form or another. However in terms of technical staff, our careers and status may have been given a boost. If you keep an eye on what is happening in the government you may have noticed that the department for Business Innovation and Skills (BIS) have decided to establish a Technician Council and have appointed Steve Holliday, Chief Executive of the National Grid as Chairman.

It would be nice to think that our continual lobbying had brought about this step forward, although if it had it would be impossible to work out how. What we do know however is that the Royal Society started the ball rolling in 1998 with their report on the lack of technical provision in research laboratories, then the ASE highlighted the problem in Schools and Colleges. HEaTED (which, I remind you, was initiated by a few IST members) has continually lobbied the higher education wing of government and we, of course, have chipped in here there and everywhere, working with Sector Skills Councils and other bodies to keep the pressure on. That, as they say, is history and is open to as much interpretation as one might feel inclined to apply. Fact, however, is that IST and HEaTED were both invited to talk to the Gatsby Foundation earlier this year for discussions. The Gatsby Foundation is one of the Sainsbury charities lead by Lord (David) Sainsbury of Turville, Science Minister in Tony Blair's government from 1998-2007. For them, this was a fact finding mission and for our part we made the strongest possible representation pointing out the issues (which surely must be common knowledge by now) and suggesting some ideas to move forward. Subsequently Matt Levi (HEaTED Executive Director and IST member) was invited to a seminar hosted by Gatsby for BIS along with a considerable number of high level people representing those areas within which one would find technical staff, for instance very senior staff from large multinational businesses as well as the NHS and the Education Sector. The establishment of a Technician Council was proposed and a few days later the following appeared on the BIS website:

UK Establishes The Technician Council To Promote A Healthy Economy

The government today* welcomed the appointment of National Grid chief executive Steve Holliday as chairman of a new national Technician Council.

The new Council will support the government's commitment to create a new technician class in sectors like engineering, scientific research and manufacturing, outlined in Skills for Growth in November last year. Business, Innovation and Skills Minister Pat McFadden said: "In securing future economic growth it is essential that we have the right people with the right skills in the right jobs. Employers must be able to find skilled technicians and be confident that their knowledge and abilities have been rigorously assessed.

"The new Technician Council has a vital role to play in bringing together all of those who employ and train technicians to make this happen.

"It will also champion rising standards and promote the immense value of technicians to our economy. I believe that Steve Holliday has the experience and ability to drive this agenda forward."

This is of course fantastic news; it means that we have now got recognition at a high level to take our profession forward. What we know beyond that however is very little: we don't know in any detail what their mission is, what their plans are, how they are funded and a hundred other questions. This, however we look at it though, is a major change and will present both opportunities and challenges to which we must respond.

The little we do know is that central to the Council's mission will be the establishment of a registration scheme which will be rigorous and of high quality. Of course registration and quality have always been in our core goals so we will be talking to the Technician Council at the earliest opportunity to let them know we have a quality product that we are more than willing to share with them. We will also, as a matter of urgency, be investigating what will be required to achieve chartered status for both the Institute and its individual members.

The last year has also been one of some frustration: lots of good positive things happening yet as an organisation we are still not managing to increase our membership as we had hoped. Except, that is, for our Fellows whose numbers are steadily climbing. So if you haven't thought about a membership upgrade, please do so; all our Fellows are happy to advise, mentor and encourage. The paperwork does look daunting at first glance and probably confusing at a second glance, but we can help you through that. Forget the form filling (we can deal with that later) and start by emailing us that you would like to be considered for Fellowship, attach a full and up to date CV and one of our Fellows will get in touch with help and advice.

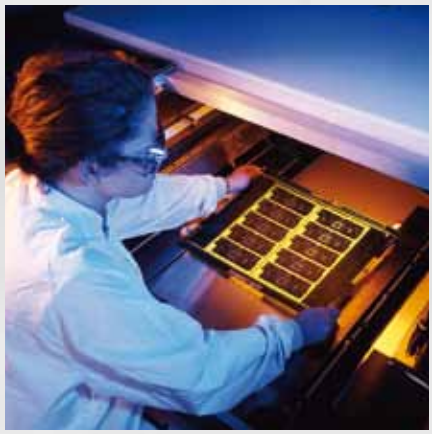
We could take the view that perhaps increasing our membership overall doesn't matter in the short term: we are financially on a sound footing, our infrastructure is robust and we have accredited qualifications. We have excellent relations with awarding bodies and sector skills councils and the government is now listening to the take home message: if we don't have proper skills training with the education to underpin it, science and technology will suffer in the long run. And it is in the long run that we will need to grow as an organisation; size, as they say, matters! The larger we are the stronger will be our voice and the more we will be heard.

Finally, I would like to thank all those who have worked for and with the Institute in the last year, in particular the members of the Executive, both collectively and individually, who keep us (and particularly me!) on the right track and the members of the Marketing and Education Boards whose expertise and advice is invaluable. In addition my thanks also go to those who work at the sharp end keeping the administrative machine running like clockwork; Joan, Wendy and Louise who have recently been joined by Jill since Louise has had a second happy event and is taking some time off; congratulations Louise! Finally, we have to thank Matt Levi and Michelle Jackson for doing such a fantastic job raising our profile in the HE sector and developing the HEaTED web site. As well as the growing Virtual Learning Environment we now have over 300 specialist short courses listed.

The last thank you is of course to your good selves, our members; it is your collective strength that enables us to progress and on behalf of the Executive I thank you all.





HE EMPLOYERS HAVE THEIR SAY ON THE TECHNICAL WORKFORCE, OPINIONS CAPTURED FOR THE FIRST TIME

HEaTED, the national training organisation that supports people responsible for technical staff training across UK HE, has just published the findings of an employer survey on the training environment for technical staff. *"Many staff surveys have been conducted in the past, indeed HEaTED ran one in 2006 and one in 2009, but this was different"*, said Matt Levi, HEaTED Executive Director. *" The surveys objective was to compliment the staff survey by finding out the views of employers as well as employees and in doing so ensuring that HEaTED services to the sector were up to date, useful and relevant"*.

"78% of employers find HEaTED specialist training courses useful for their staff"

"63 HE members and more knocking at the door"

Publication of this coincides with the third HEaTED (Spring) Newsletter that keeps training and development colleagues informed of over 240 specialist skills courses for technical staff, as well as profiling technical staff case studies and talking about the future of this service that now has over 60 HEI members up and down the UK. In this edition Professor Keith Burnett, Vice-Chancellor of Sheffield University and Chair of HEaTED makes it clear that all in the HE sector have a role to play in influencing the future of HEaTED.

Professor Burnett said *"I have been so impressed by the energy and enthusiasm that has been generated for the HEaTED initiative and delighted by the huge range of activities and subsequent support that there is for what we are trying to do, not just for Technical Specialists but for the whole of HE"*.

"HEaTED has done fantastically well in such a short space of time. We are currently attracting huge interest and engagement and growing as an organisation more now than ever as our message gets through, but we need more time to cross the self-sustainability threshold. If we could find funding to support us for a minimum of another 2 years we could realise the great potential HEaTED has and lay down a legacy for future HE and Education Technicians generations to come. The alternative is to lose what we have built and no-one can surely think that is an option given the progress and achievements. The damage to HE and Education in the UK would be irreversible".

MATT LEVI, HEATED EXECUTIVE DIRECTOR

Despite this universally positive response to HEaTED from employers and technicians themselves the agenda is in jeopardy unless further partial funding can be found from September 2010.

More information on HEaTED and links to the Employers Survey Report and Spring Newsletter can be found on the HEaTED Website www.heated.ac.uk

For more information contact:

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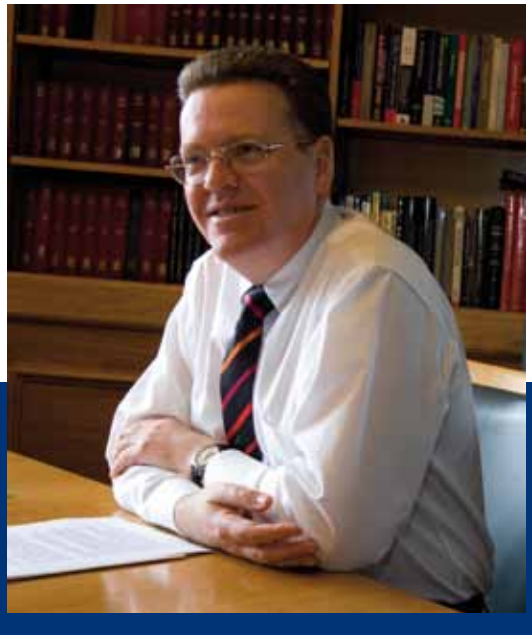
www.heated.ac.uk

It's tough out there...



Professor Keith Burnett, Vice-Chancellor of The University of Sheffield and Chair of HEaTED makes it clear that we all have a key role to play in influencing its future.

"The simple fact is that if we do not grasp this opportunity we will lose it"

Dear Colleagues,

I do not need to tell you that these are difficult times, not only in Higher Education but for the whole of the UK workforce. We have to move forward positively and we have and are doing so. I have been so impressed by the energy and enthusiasm that has been generated for the HEaTED initiative and delighted by the huge range of activities and subsequent support that there is for what we are trying to do, not just for technical specialists but for the whole of HE. After all, we are all in the same boat with all of our HE colleagues and need to work closely together as fellow professionals and partners.

At long last this is no longer a HE issue alone but a wider UK capacity and development issue for the technical workforce and the contribution made to UK wellbeing and success. Lord Sainsbury recently held a seminar in London to begin to address the UK wide issues and I am pleased to say that HEaTED were represented at that event by Matt Levi, our executive director. However, we in HE recognise that while wider political developments take their course that the need to push forward with our own immediate message in HE and the delivery of world class technical and educational services whilst being delighted to welcome colleagues from other educational institutions across the UK Educational spectrum, which is crucial now.

What can you do?

Engage – if your HEI is a member, look at the services available and give us your feedback. Please tell your colleagues. If your HEI is not yet a member please do not feel excluded, you can still contribute. A conversation with your HR and Staff Development colleagues will help spread the message, and you are encouraged to talk to us at HEaTED. The simple fact is that if we (UK Higher Education) do not grasp this opportunity we will lose it and everyone working in HE and wider will regret that in the not too distant future. Please engage and contribute, we cannot do it without your support. Together we could have a top class development service for Technical Specialists working in UK Education for the foreseeable future.

Please make your voices heard.

Professor Keith Burnett

HEaTED
HIGHER EDUCATION & TECHNICIANS EDUCATION & DEVELOPMENT

An interview with... Professor Lawrence M. Krauss

Estelle Asmodelle ▶

In the last decade the science of cosmology has really come into its own, while many world renowned scientists in the field have become public icons and popular science superstars.

Prof. Krauss is one such scientist with a reputation of being unorthodox, outspoken, and a unique force as a theoretical physicist. He has published over 200 scientific papers, been the winner of numerous prizes and awards, appears regularly in the media on TV and radio, and is also the best selling author of seven books, the most recent being; *Hiding in the Mirror, The Mysterious Allure of Extra Dimensions, from Plato to String Theory and Beyond. (Penguin,* 2006)

Lawrence M. Krauss is director of the *Center for Education and Research in Cosmology and Astrophysics* at Case Western Reserve University in Cleveland, Ohio. He is also chair-elect of the *Forum on Physics and Society of the American Physical Society*.

Australian writer, Estelle Asmodelle puts some contemporary questions to Prof. Krauss.

ESTELLE ASMODELLE: Do you see the Intelligent Design issue as the general demise of empirical thinking in our society; by educators and scientists alike?

LAWRENCE KRAUSS: I see it as symptomatic of a general scientific illiteracy which is too prevalent in our society, and which is one of the reasons I, as a physicist, am spending time on this issue. I also see it as representing an inappropriate 'fear' of science that I would like to help people overcome.

EA: As a particle physicist as well as a cosmologist and a proponent of the Standard Model in particle physics, what do you think of the recent claims of the Higgs Boson detection?

LK: I never believe claims of anything the first time around… I find I am less disappointed that way.

EA: From a philosophical point of view do you think incorporating the Anthropic Principle into cosmology is a normal part of the scientific process, or it is something else?

LK: I think it is a sign of desperation, and lack of other good ideas. Once some interesting physics is discovered, this too shall probably pass.

EA: Now let's talk about an area in which you have made a significant contribution; Dark Energy. How do you envisage testing the existence of Dark Energy without relying on SNe (Supernovae) 1A data?

LK: Alas, while I am quite proud to have 'predicted' the existence of dark energy before it was directly inferred from SNe observations, I am also quite pessimistic about the possibilities at this point in experimentally uncovering its nature. I think observation will not give us any good handle on whether dark energy is a cosmological constant or not, and we will unfortunately have to rely on theory.

EA: In a recent paper you published collaboratively there is mention of the cosmological constant being distinctly different from Dark Energy. Can you explain the relationship between the two as you see it?

LK: Well, the most likely possibility for dark energy is that it is a cosmological constant, or, as it is better known today, the energy of the vacuum. Unfortunately, there are many other forms of energy that might masquerade as this, and we would never know it.

EA: In reference to WMAP data; the scientific community seems convinced, beyond a shadow of doubt, that the Cosmic Microwave Background is the direct evidence of the Big Bang, but is there any possibility the data could be corrupted by black body radiation from nearby galaxies?

LK: I think it is quite possible that certain aspects of the data could be corrupted by foregrounds, but that wouldn't change the fact that it is indeed evidence of the Big Bang. The evidence is just

too overwhelming, from the beautiful black body nature of the radiation, its temperature, the magnitude of fluctuations etc…

EA: In your new book, *Hiding in the Mirror*, we are led on a very interesting exploration into the search for hidden dimensions, but I sense that you in fact think that those hidden dimensions do not exist. If this is true what fate do you think is in store for String Theory or M-theory?

LK: I think String Theory is in the doldrums right now. It is a fascinating idea, it just hasn't gone anywhere. We will need new particle physics data, I think, before we have any indication that String Theory, and also the possibility of extra dimensions, has anything to do with our universe.

EA: One of the most difficult and seemingly insurmountable problems in cosmology has been the unification of the General theory of Relativity with Quantum Theory. What approach do you think will lead to this unification; will it be a philosophical issue, or a pure science and mathematical issue?

LK: I hope it will be a scientific issue… and if I knew of a good approach, I would be doing it right now! In fact, I have a few ideas and will let you know if they work out…

EA: As someone who follows the scientific method fairly stringently, in the sense of building an understanding of the universe based on all the work that has gone before, do you see room in physics and especially cosmology for alternative theories; such as MOND (MOdified Newtonian Dynamics), and also other more controversial theories such as VLS (Variable speed of light)?

LK: There is always room in physics for alternative theories. That is how we make progress. You just have to realize, however, that most of these ideas will be wrong… indeed, many of my own beautiful theories (at least I thought so), have not been taken up by nature. As for the two you mentioned… I wouldn't bet on either.

EA: Undoubtedly you've had a stellar career so far and I'm sure there is much more to contribute. However as someone who is involved in so many activities do you feel that less time is spent on actual pure research these days?

LK: I try to balance things when I can, so that I work intensively on a Research project, and then work on other things, or travel and give lectures. Of course I cannot control this completely, and when I am upset about some public policy I end up writing something, even if it is the middle of the night. But inevitably the outside activities do impact upon research time. It is a compromise in the end. But usually one I cannot control… namely, I feel like a fraud if I am not doing research, and I feel negligent if I am not also doing something else.

AUTHOR

Estelle Asmodelle is a professional computer scientist and CEO of Ellenet Pty Ltd, a digital solutions provider in Sydney, Australia.

Originally Estelle studied towards a mechanical engineering diploma, then a BSc in Physics, and eventually settled for a computer science degree. Following in the family tradition, Estelle became an inventor and in the early '90s was contracted by large Japanese corporations such as Hitachi, NSK, Nachi-Fushikoshi and Nippon Seiko for licensing rights to her designs and algorithms, and continued as a specialist consultant for those companies. She lived in Japan for 5 years and is fluent in Japanese.

In 2000 Estelle started Ellenet Pty Ltd. She is also a co-director of Electrical Vehicle Road Technologies Pty Ltd and of Ellex Com Pty Ltd, companies that are involved in advanced research and development in robotic control systems, with consultants working at Australia's University of Newcastle and the University of Technology, Sydney. Estelle has over a dozen patents and articles in technology publications about her work in robotics and machine control systems.

Although currently a director of 5 companies, this busy work schedule hasn't stopped Estelle from continuing her passion for astronomy and cosmology as she works towards a BSc (Hons) in Astronomy with the University of Central Lancashire, in the UK.

She is active in writing about astrophysics, is an Associate Member of the Institute of Physics (UK) and a member of the Australian Society of Authors.

See more details at: www.ellenet.net and also www.evrtech.com/index.php

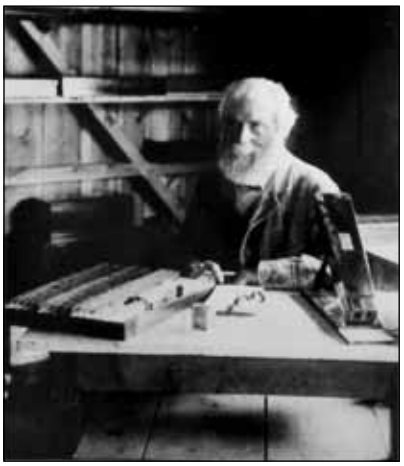
Joseph Lovibond & His Tintometer

Alan Gall, IST Archivist ▶

The Scottish physicist James Clerk Maxwell is well known in the scientific community for his elegant equations that define the fundamentals of electromagnetism. Combined with the Lorentz force law, these equations govern all basic aspects of the subject. Maxwell's great achievement was to obtain a modified form of Ampère's law that predicted radio waves, later transmitted and detected by Hertz. But before Maxwell succeeded in bringing about the mathematical marriage of electric and magnetic phenomena, he had pondered deeply on the subject of colour, famously an area of study by Isaac Newton. Maxwell's untimely death in 1879 at the age of 48 no doubt robbed us of further early developments in this field[1]. Twenty-six years later, brewer Joseph Lovibond formed The Tintometer Ltd to manufacture his patented measuring instrument, originally inspired by the need to quantify the colour of beer.

Introducing Joseph Lovibond

During a presentation given to the Colour Group of the Physical Society in 1943, Gerald Sidney Fawcett spoke about a man '…to whom science and industry are, in no small measure, indebted.' Fawcett could speak with some authority[2] since he was the grandson of Lovibond and a director of The Tintometer Ltd since 1930. His talk, on 'Sixty Years of Colorimetry', gave details of Lovibond's life.



Joseph W.Lovibond at work with his coloured glass slides

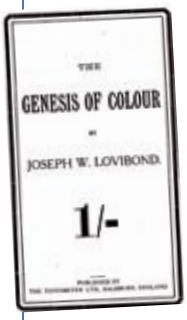
Joseph Williams Lovibond[3], born 17 November 1833 at Long Sutton, Somerset, was the third son of John Locke Lovibond. At the age of 13 he joined the Merchant Navy and went to sea under a Captain Aitken. Conditions on board were unpleasant enough for him to jump ship by diving overboard in an Australian harbour, apparently preferring to brave shark-infested waters rather than another voyage with Aitken.

He then turned his hand to gold prospecting at Ballarat, in Australia, before moving on to the gold fields of California around 1849. He might have returned to England with a decent reward for his efforts, except for an unfortunate incident. Whilst saying his farewells to friends ashore a cache of gold dust fell from his hat into the sea.

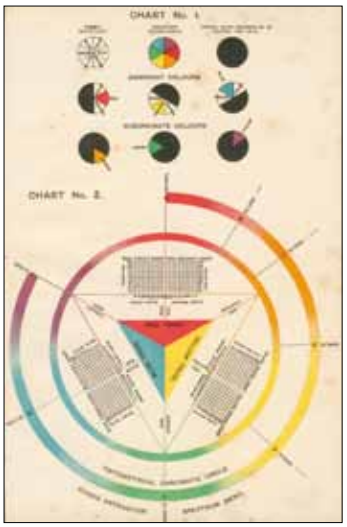
Meanwhile, Joseph's father and two brothers had been running a brewery in Greenwich. John Locke Lovibond had started a brewery at Frome, Somerset in 1834[4] and acquired the Nag's Head Brewery on Bridge Street in Greenwich during (or shortly after) 1847. Joseph joined the family business around 1854. The enterprise subsequently expanded. In 1865 a new brewery was built on Greenwich High Road and Joseph moved to Salisbury in 1869 to acquire another facility, the St Anne's Street Brewery[5].

Joseph W.Lovibond at rest

Colour Perception

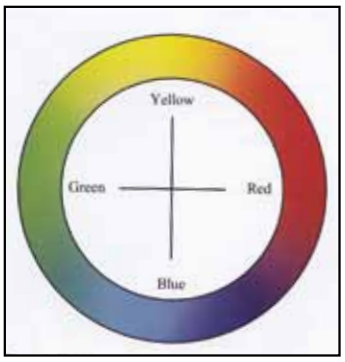


Out of the huge span of wavelengths in the electromagnetic spectrum, there is an extremely narrow range of values that represents all the colours visible to the human eye. Ranging from about 0.39 micrometres at the blue end to 0.70 micrometres at the red end, they are interpreted by the brain via receptors in the retina. It was in 1777 that the dye chemist George Palmer proposed what eventually re-appeared in refined form as the Young-Helmholtz theory of colour perception. In this later theory, three types of receptors were proposed, each sensitive to a particular colour: blue, green and red (Palmer's were blue, yellow and red). Experiments show that the receptors (cones) are stimulated to about the same degree by red and green but respond weakly to blue. This explains why hot stars observed in the night sky appear less blue than they do when photographed, because colour film has a better sensitivity to blue.



Illustrations from the Journal of The Society of Dyers and Colourists, February 1908, in an article called 'On a method of Identifying and Valuing Dyestuffs'

Colours are generally described with regard to three key attributes:



Hue

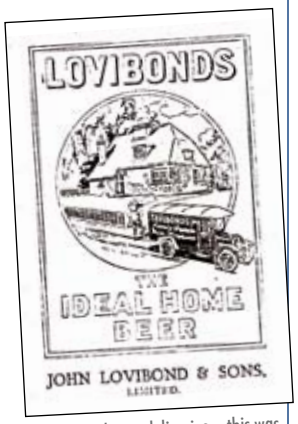
hue, chroma and value. Hue gives the name that we have learnt to associate with the sensation called colour as seen in rainbows: red, orange, yellow, green, blue, violet, and their combinations on the 'hue circle' such as green-blue. Chroma, or saturation, is a value that increases as the colour tends to a

Chromaticity

pure hue and decreases as the colour becomes greyish. The two extremes of the third variable, value, are black and white, so value gives the 'lightness' of a colour. The development of methods for assigning numerical values to any given perceived colour is a fascinating subject, but beyond the intended scope of this paper.

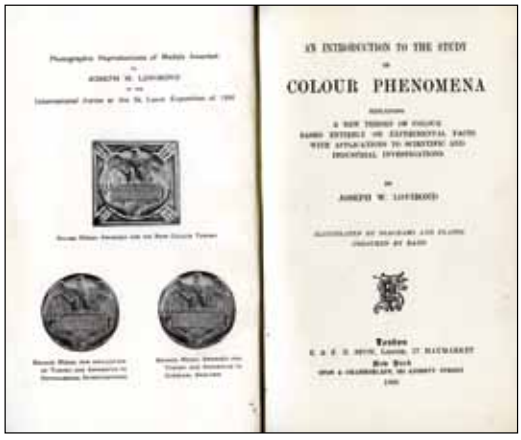
The Colour of Beer

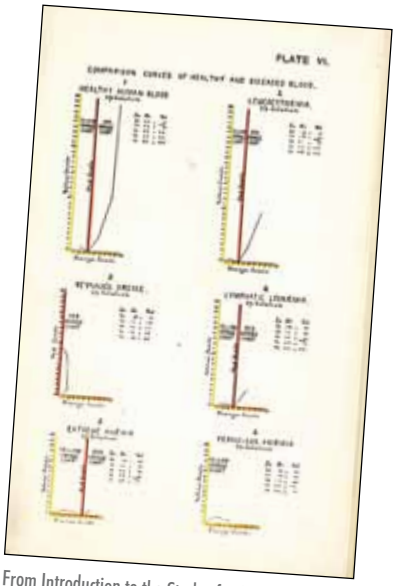
When J.W.Lovibond joined the family brewery he found that there was no simple method available for measuring the colour of beer and wort (malt solution). Not a major worry for brewers of the time but nonetheless a subject that appealed to Lovibond's inventive nature.[6]



Advertising home deliveries – this was registered as a trade mark in 1925

According to G.S. Fawcett, Joseph purloined a tea caddy from his wife's kitchen and cut observation slots in front and back. By this means, two glasses of beer could be compared with each other. This led on to thoughts of how to prepare standards so that comparisons could be made and the results recorded numerically. Chemical solutions approximating to the various shades of brown were tried and found unsatisfactory because of long-term stability. Then came the answer: '…after extensive searches through the bins of several glass merchants, Lovibond was successful in finding a few samples of amber-coloured glass which very closely resembled the colour of malt worts and beer.' To control the conditions under which determinations were made, he devised an instrument with an eyepiece that allowed the simultaneous observation of the sample and one of a series of coloured glass slides numbered 1 to 20. Extending the idea for use in other industries resulted in a multitude of arbitrary colour scales and before long he adopted the idea of using combinations of red, yellow and blue glasses, of various intensities, to make the matches. The numbering system formed an arithmetical progression so that (for example) number one and two in red, when combined, gave the same intensity as a number three.





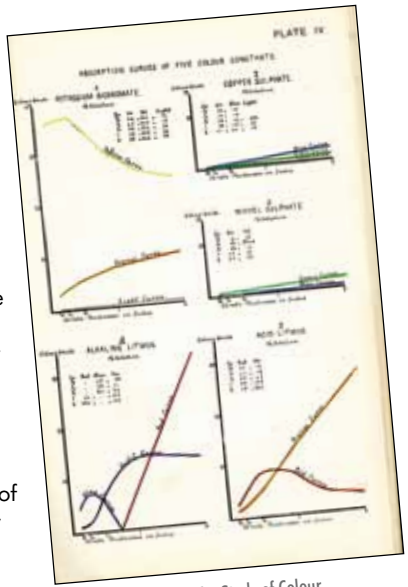
From Introduction to the Study of Colour Phenomenon (1905)

The Tintometer Ltd

Joseph lived next door to the St Anne's Street Brewery and the early work on colour measurement was done in the summerhouse at the rear of his home. With (or around the time of) the incorporation of The Tintometer Ltd on 23 August 1895, he ceased to play an active role in the management of the Salisbury brewery[7], which continued to run as John Lovibond & Sons, under the management of his nephew Joseph.

Tintometer's premises stood behind the brewery, at No 1, The Friary, home for the next 35 years. Joseph's wife, Charlotte, died in 1896 and shortly after this he bought the Lake House estate, some six miles from the centre of Salisbury, where he lived for a time with a retinue of servants. His occupation of Lake House was not continuous. For part of the time Joseph used a smaller house called 'The Pleasaunce'[8]. He leased Lake House to a Liberal MP, Percy Illingworth, in April 1912 and within days the place was almost totally destroyed by fire. Today, the musician and actor called Sting (Gordon Matthew Thomas Sumner) lives in the rebuilt mansion.

Lake House is situated at the village of Lake, close to the River Avon. Joseph provided work for the locals by setting up a cottage weaving industry. These activities were later moved to the Tintometer factory in Waterloo Road where three large looms were installed. After WWI, the weaving gave employment to disabled ex-servicemen, operating under the name of Stonehenge Woollen Industry Ltd. The cloth produced had a ready outlet – via Arthur Fawcett's[9] three shops in the West End of London and one in Salisbury High Street.



From Introduction to the Study of Colour Phenomenon (1905)

Tintometer's Articles of Association in 1895 included provision for publishing books and these were forthcoming from J.W.Lovibond, such as: *Measurement of Light and Colour Sensations* (1893), *An Introduction to the Study of Colour Phenomena* (1905) and

Light and Colour Theories and their Relation to Light and Colour Standardization (1915). He also wrote extensively for various professional bodies, like the Society of Dyers and Colourists, the Institute of Brewing and the International Society of Leather Trades Chemists.

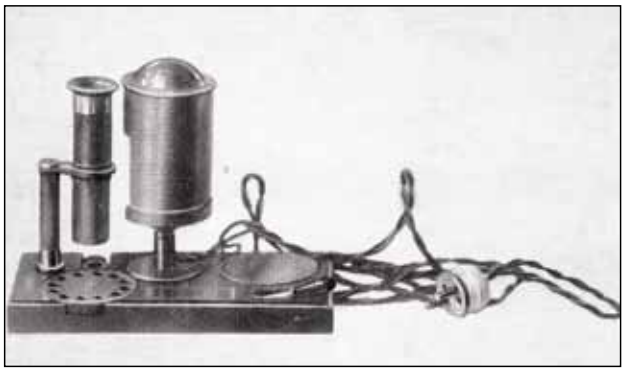
In a paper on 'Measurement of Fog Densities', presented at a meeting of the Royal Meteorological Society in 1907, Joseph described his 'Tintometric Light Units', a luminous intensity scale running from 1 to 32. Defining 32 as visibility under broad daylight conditions, 1 represented the darkness that reduced vision to the point at which the 'sky line at 1500 yards [is] just distinguishable'. To the criterion 'cannot read The Times newspaper' he gave a value of 29.

It was in 1930 that Tintometer moved to a former flour mill that had been unused for a number of years. This stood at the end of Waterloo Road, Salisbury where adjacent land provided room for expansion. After refurbishing the buildings, furnaces were installed for the manufacture of glass colour standards. A second factory was opened in 1969 at Wadebridge, Cornwall.

Some Tintometer Products

Soon after establishing the utility of the comparator in brewing, the extension of the principle to other industries followed. Paint, sugar, edible oil, flour, wine, malt, tanning solutions, all of these products and more have colour measurement as a useful parameter.

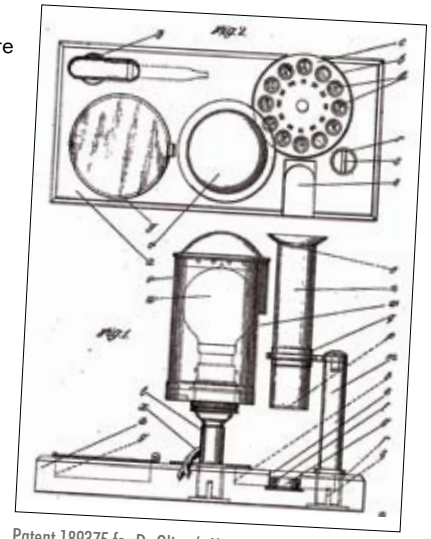
An interesting instrument featured in an old brochure (undated) is the No.4 set, used for estimating the colour and turbidity of water. The instructions include the advice: 'The Tintometer must be set up facing a North Window over which a sheet of the special diffusing paper screen has been placed.' A platinum coated needle, devised by Dr J.C.Thresh, was offered as an optional extra for the turbidity measurements.



Dr Oliver's Haemoglobinometer (note the two-pin mains plug, then in use)

By moving the needle through the sample (contained in a long glass cell) until it was just visible, the turbidity could be expressed in terms of a distance scale. John Clough Thresh, Medical Officer of Health to the Essex County Council around the turn of the last century, had other devices to his credit. His incubator and condenser could be bought from A.Gallenkamp & Company (1902 catalogue) and he held patents on apparatus relating to disinfection and water purification. He was even a director of the Manchester firm Stelfox Ltd[10] that specialised in the construction of scientific equipment from sheet metal and supplied the University of Manchester.

Another device on offer was an improved form of Dr Oliver's Haemoglobinometer[11], the subject of a patent by Frances Elizabeth Baker in 1922. The sales literature boasted certain advantages of the modified instrument such as: 'Electric light is used instead of a candle'. Frances Baker married Joseph Locke Lovibond, the son of Joseph Williams Lovibond's brother Edward, in 1922. She had been a director of Tintometer since before WWI and very active in technical development. Other members of the board (as of 1919) included the daughters of Joseph Williams Lovibond. It seems that the Salisbury brewing industry provided a happy hunting ground for spouses. Amy Lovibond married John Folliott (of the firm John Folliott, Old George Steam Brewery) and Charlotte married Sidney Fawcett (of W.Fawcett & Sons, Endless Street Brewery), all in 1887.



Patent 189375 for Dr Oliver's Haemoglobinometer (1922)

G.W.G.Kaye, in his *The Practical Applications of X-Rays* (1922), notes that there are several ways to measure the degree of exposure a patient receives from X-rays: 'Of all the various intensity measurers, the pastille[12] finds most favour with medical men in this country. '…but the colour matching cannot satisfactorily be carried out without a tintometer, for example, of the Lovibond type.'

This method stemmed from the investigations that Joseph had conducted in collaboration with doctors at the Salisbury Infirmary.

British Drug Houses Ltd[13] and Tintometer Ltd established a financially beneficial relationship that greatly assisted Tintometer's sales during the trade depression of the late '20s and early '30s. BDH's interests in analytical testing led to the development of 'The BDH pattern Lovibond Tintometer'

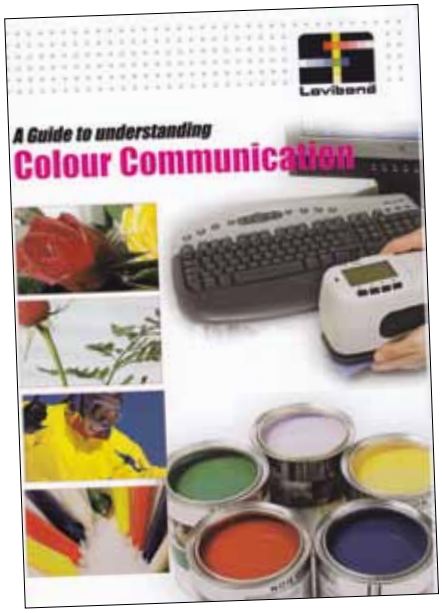
The British Drug Houses pattern Lovibond Tintometer from the 1965 BDH catalogue

Modern version of the Tintometer, model AF710-3

in their own research laboratories, largely under the direction of Thomas Tusting Cocking who was working on Vitamin A estimations. The BDH catalogue of 1965 shows the device (pictured) and recommends the additional use of a white light cabinet. The Tintometer, being a subtractive colorimeter[14] requires a standardised light source to be most effective.

Exit Joseph Lovibond

In addition to his professional duties, Joseph was Mayor of Salisbury in 1878 and 1890 and variously acted as a Magistrate and County Councillor. He experimented with military camouflage, which the Admiralty encouraged to some extent by providing facilities to carry out tests around Portsmouth in 1915. Other interests were reinforced concrete and scientific trout breeding. On his 80th birthday he was still able to ride a horse to the local foxhounds meeting. He died on 21 April 1918, leaving a personal estate with a gross value of £33,392.



Postscript

John Lovibond & Sons Ltd, brewers of Greenwich, made its last batch of beer in 1959. It continued to trade with a chain of off-licences until acquired by Wine Ways Supermarkets Ltd in 1968. In 2005, Jeff Rosenmeier resurrected the old name when he formed Lovibonds Brewery Ltd in Henley-on-Thames.

The Tintometer Ltd continues to be a leader in the field of colour measurement, now based at Solstice Park, in Amesbury[15].

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Jeff Rosenmeier of Lovibonds Brewery Ltd.

Notes

[1] Maxwell had produced the first colour photograph in 1861.

[2] G.S.Fawcett's article contains some dates that are slightly in error. The date of Tintometer's incorporation is 1895 (1896 given) and the death of Joseph Williams Lovibond is 1918 (1917 given).

[3] Joseph Williams Lovibond is referred to simply as 'Joseph' in most of this article.

[4] Early details of the brewery's foundation are open to question and require verification.

[5] On more modern maps it is marked as St Ann Street.

[6] For example, in addition to several patents related to colour measurement he patented 'An Improved Combined Forcing Frame and Light for use more particularly in Intensive Cultivation' in 1908.

[7] He then became Chairman of John Lovibond & Sons Ltd, serving in that capacity until his death.

[8] Gordon Chamberlin's article records that this was built by Joseph using reinforced concrete, incorporating broken railings and iron bedsteads.

[9] Arthur Joseph Fawcett, son of Sidney who married Charlotte Lovibond.

[10] It is likely that Stelfox Ltd constructed in part, or in full, some of the equipment used by Ernest Rutherford at the University of Manchester. Stelfox Ltd went into liquidation during 1928.

[11] Developed by George Oliver (1841-1915) to measure the haemoglobin content of the blood.

[12] In this particular application, a pastille is a small disc of barium platinocyanide. Initially green, it turns orange with exposure to X-rays.

[13] Became BDH Ltd, then taken over by Merck of Germany in 1973. After further transitions it is now a component part of VWR International Ltd.

[14] Starting with a beam of white light, colours are produced by removing certain wavelengths as the beam passes through coloured transparencies.

[15] The Tintometer Ltd moved from Waterloo Road to the present site in December 2005.

Cosmetics In The 18th Century

Julia Hyland ▶

The eighteenth century is sometimes called the Age of Enlightenment though most fashionable men and women were poisoning themselves with a variety of toxic cosmetics. It was known that the use of lead, arsenic and mercury in make-up could cause serious health problems (Swinfield, 1999: 97).

According to Baker (1993: 210) lead is easily absorbed by the body leading to severe side effects.

> *…eyes to swell and become inflamed, attacked the enamel on the teeth and changed the texture of the skin causing it to blacken. Dizziness, nausea, stomach and bowel problems, blindness, sometimes paralysis and even death.*

While Bubonic Plague had ceased to decimate Europe by this time, disease was still rife, diets and sanitation were poor. Faces were pockmarked by smallpox and syphilis; tooth loss caused sunken cheeks and the lower classes were prematurely aged due to poor diet, heavy drinking and disease.

During this century men and women continued to whiten their faces with white lead based pigments such as ceruse or cerrusite. Other cosmetics such as eyeshadow and lipstick also are known to have contained high levels of mercury and arsenic. 'Spanish Wool' (An impregnated pad of hair – like a 'Brillo' pad) was sometimes used to brighten the cheeks. This pink rouge is known to have contained cadmium, a highly toxic metal, use of which causes lung damage and

kidney damage. According to Angelolou (1970: 83) lips were also painted with 'Spanish Wool' and cinnabar, a mercury compound, although less harmful natural pigments such as carmine and vermilion were also known to be used.

Oily pomades of animal fats were applied to the hair to keep elaborate styles in place, as were coloured powders of starch or flour, also applied to the shoulders and breasts. For a while it was fashionable to paint the veins on the bosom in blue! The breast was the vogue of the eighteenth century, but the skins of the most fashionable bosoms' were 'scabrous with inflammation' (Angeloglou, 1970: 79).

Ladies (and Macaronis) had a range of cosmetics at their disposal. White lead powder mixed with egg white could be used to give a fine, pale complexion, although ladies taking the waters at Bath were warned that 'those who use white paste as a cosmetic are liable to have skins turn entirely yellow' from the vapours of the springs. Rouge was also made from a mixture of lead paste and carmine.

Women's eyebrows were plucked thin, pencilled high and curved, or shaved and replaced. The eyebrow could be of any colour and artificial eyebrows were glued on. It was popular, for a time, for society ladies' eyebrows to be made of mouse skin, but unfortunately the heat of the ballroom sometimes caused them to slip.

Reference to eyebrows made of mouse skin can be seen in Jonathan Swift's A Beautiful Young Nymph going to Bed, 1751. In it he describes the following chorus girl:

> *Now picking out a crystal eye,*
> *she wipes it clean, and lays it by.*
> *Her eyebrows from a mouse's hide,*
> *stuck on with art on either side*

Patches in the shape of stars, hearts, half moons, roundels, even birds were worn on the face and cut out of black taffeta, Spanish leather or gummed paper. These were useful in covering up scars or skin afflictions such as smallpox, while the fan also helped to hide the face.

Angeloglou (1970: 74) tells us that patches were seen as a symbol of political allegiance - depending on which side of the face a patch was worn, Whigs on the right and Tories on the left. At the court of Louis XV, a patch worn at the corner of the eye indicated passion, the centre of the cheek was gay, the nose was saucy, a patch on the upper lip suggested kisses and the forehead was majestic. A patch worn on a dimple was playful. Murderesses were known to wear patches on the breast! Often people wore up to fifteen or sixteen patches at once.

Maria Gunning 1733 – 1760: victim of cosmetic poisoning

Two accounts of cosmetic poisoning have been mentioned in history (vbltcollection.org.uk). Maria Gunning, Countess of Coventry, died at the age of twenty seven as a likely result of using lead-based cosmetics and actress Kitty Fisher, some sources say, also died from the effects of lead-based cosmetic use, at the age of twenty-nine.

Face masks were worn outdoors, made from black silk or velvet, stiffened with fine leather or buckram and may explain the relative unimportance of eye make-up at the time. More common was the half-face shape which circled the eyes, tied behind with ribbons. Full-face masks were known to be used on the continent, but were not popular in England.

The Pharmaceutical Journal (2002: 375) gives us a description of the ideal face. Crito: or A Dialogue on Beauty written in 1752:

> *The forehead should be white, smooth and open. The skin in general should be white, properly tinged with red with apparent softness and a look of thriving health in it. The cheeks should not be wide; should have a degree of plumpness, with the red and white finely blended together. The eyebrows, well divided, rather full than thin, semi-circular broader in the middle than a the ends. The mouth should be small, and the lips not of equal thickness. A truly pretty mouth is like a Rose-bud that is beginning to grow....*

Later the government at the time tried unsuccessfully to pass an Act of Parliament to protect men from being deceived into marriage:

> *To protect men from being beguiled into marriage by false adornments. All women, of whatever rank, age, profession or degree, whether virgins, maids or widows, that shall, from and after such Act, impose upon, seduce or betray into matrimony, any of His Majesty's subjects, by the scents, paints, cosmetic washes, artificial teeth, false hair, Spanish wool, iron stays, hoops, high-heeled shoes and bolstered hips, shall incur the penalty of the law in force against witchcraft and like misdemeanours and that the marriage upon conviction shall stand null and void.* (Brown, 2002:375)

The first school of hairdressing and wig-making opened in Paris in The Académie de Coffure, 1768. Hairdressing and wig-making became extremely popular at this time, with hair becoming higher and higher until the middle of the 18th century when the hair was the most excessive it has ever been.

These extreme styles were achieved with the addition of horsehair pads, false and crepe hair which was dressed over wooden and iron frames. Not surprisingly many suffered scalp problems. Long scratching sticks were used as some heads were infested with lice, even mice were said to have nested in some of the creations – attracted by the lard used to sculpt the hair into place, although this has never been substantiated.

Feathers, ribbons, jewels, even vegetables and other decorative ornaments also appeared at this point in time, mounted on top of the head. All hairstyles were powdered for formal occasions, usually with white lead or flour but sometimes grey, blue or lilac colours would be used while some were known to use gold dust (Baker 1993: 211). Dressing the hair was time consuming and expensive and had to last as long as possible. Combing and brushing the hair was impossible once finished and as a result hair styles were kept in for several weeks or months, which made sleeping difficult, sometimes accomplished with the head on a curved wooden block to protect the style (Swinfield, 1999: 97). Many men and women shaved their heads for ease and comfort and resorted to wearing wigs.

Most 18th Century men wore wigs, regardless of income and every village had its own wig-maker. There were a wide variety of styles to choose from, one of the most important at this time being the Campaign Wig, worn by military men. Some of the older men still wore the full-bottomed wigs (Baker, 1999, 100). Highly fashionable fops, known as The Macaronis, chose elaborate high wigs sometimes worn up to 18 inches high, so carrying men's fashions and cosmetics to a new extreme.

The Town and Country Magazine of 1764 described them thus:

> *They make a most ridiculous figure… it is a puzzle to determine the thing's sex*

By 1768 men's eyebrows had changed to black, darkened with lead. Often they continued to shave off their own and repaint them in. Cheeks were heavily

rouged by the men who also reddened their lips (Delamar, 1995, 68).

False teeth were often made to replace lost ones. There had been previous attempts to thread wood or bone onto wire and insert them into the mouth but they were considered clumsy and painful. Most people accepted their black stumps and dentists were nothing more than low status barber surgeons. Breath sweeteners are described, such as cloves, cinnamon, bramble leaves and honey mixed with burnt ashes – which ultimately rotted the teeth but temporarily gave sweet breath (Angeloglou, 1970: 71).

There were many beauty treatments around at the time and adverts included a 'Chemical Wash' to improve the skin:

> *By taking off all deformities…as Ringworms, Morphew, Sunburn, Scurf, Pimples, Pits or Redness of the Smallpox, keeping it of lasting and extreme Whiteness…"* (Angeloglou, 1970: 73)

A tax on hair powdering and wigs was introduced in 1795 but the extreme hair and make-up styles had ended in the 1780's with the French revolution, after which, make-up and hair became more natural (Baker, 1993: 211).

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AUTHOR

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Supporting Science and Technology in Libya

Derek Sayers ▶

Libya must be one of the most maligned countries in the world. Many tourists still view visiting the country with trepidation, a fear which is quite unfounded. I first went to Tripoli, Libya in 1989 just after Tripoli was bombed by the Americans from a base in the United Kingdom. At that time the Foreign Office had strongly advised me against visiting the country. I therefore entered Libya with serious doubts as to my safety; in fact my wife had demanded that I updated my Will before I left the UK. I had to fly to Libya via Malta because at the time no British aircraft were allowed to fly to Libya and hence I had to use the Libyan-Arab Airline from Malta. On arrival at the airport in Tripoli my passport was taken from me. This was a normal procedure whilst you change at least 100 American dollars into dinars at the Government rate of exchange. As I was travelling on business I did not need to change any money – I hoped. I stood around in the arrival area wondering what I had to do next. I saw another chap from the UK standing there, so I asked him-

"What happens now?"

"Don't know mate" was his reply

"Your first time too is it?" I asked

"No, this is my 97th visit and it has been different every time!"

I found out that he was working for one of the oil companies.

On one of my later visits I arrived at Tripoli Airport and once again got through their controls without changing any money into Libyan dinars. I was to be met at the airport which is 18km from the centre of Tripoli. It was 10.00pm and my lift had not arrived. A taxi driver came up to me and I sent him away saying I was being picked up. Thirty minutes passed, I had no money and no telephone number to contact the oil company.

"Where is your lift?" the taxi driver said

"I don't know" I said. I also told him the name of the oil company

"Come we go" he said

"I cannot pay you, I have no dinars" I said. It was illegal to offer US dollars – the other currency I always carried.

"I take you for free – you are a guest in my country" he said

After that whenever I arrived at Tripoli Airport he was there and I used him often; we became good friends – I always paid him after that first journey.

Contrary to popular opinion the Sahara is not all sand dunes; much looks like a sea where the water has drained away. In fact, the area shown (about 400kms inland) there are many sea shells, millions of years old, littered all over the ground together with petrified wood.

I still needed to change some money into dinars and I learned very quickly that it was far better to do this on the black market where you could get up to six times the government exchange rate for US dollars. It was highly illegal. At the time Libyan dinars were worthless outside of Libya and therefore foreign currency, especially US dollars were like gold dust to traders. The trick was to know the shop where you could do the exchange. You picked up some odd item, for instance, the painted papyruses in one shop were this was the 'ticket' for exchange. I would ask how much and he would write on a piece of paper how many dinars he would give for 100 US dollars. I would then hand over the dollars and he would give me change in dinars. We would make sure the shop was empty when we did the transaction anyone more than a few metres away would have not spotted what was going on. Today it is perfectly legal to exchange money so the black market trade has vanished.

Oil Companies

My initial business there was to make an inventory and report on the condition of all the medical equipment owned by the Mobil Oil Company prior to the company becoming Libyan and part of Veba Oil Company. On my first visit to Africa and also to an Arab country, I

Valley of 'monuments'
To get from one Oil Field camp to another often meant travelling across the Desert...

did not know what to expect. My first impression was that it was very dusty and perhaps a little ramshackle, however this is a desert country and I realised later it was no worse than any other North African country. After visiting the Company Medical Centre in Tripoli, I was sent by aircraft out into the "field". This meant visiting the clinics in each of the oil fields owned by Mobil/Veba in the desert. They are situated in the northern part or Libya penetrating to about 400km into the desert. There are a number of oil companies in Libya, each have a number of 'fields' in the desert and some also have oil rigs out in Mediterranean. Each field has its own "camp" which can house from perhaps forty upwards to several hundred men. The facilities available depend on the size of the camp. The smaller ones only have accommodation huts, a mess hall, medical centre, workshops, social club and of course an airfield. The larger ones resemble a holiday hotel with a big mess hall with a large choice of food and ice cream on tap (help yourself). There is also a swimming pool, tennis courts, large social club with games rooms,

...In one area there is a valley of massive monoliths some 2-300 feet high, worn into fantastic shapes by millions of years of wind and sand erosion.

cinema, cafe etc. Everything is free except cigarettes which you have to buy. As it is a Moslem country, alcohol is not sold, however the 'ex pats' are allowed to brew their own as long as they do not give it to the Libyans. Around every camp there are trees, flower beds and fountains that are watered every day by the many Filipinos employed there. On my first visit I asked where all the water came from, as I thought there was no water in the Desert. I was told:

"If we can drill for oil then we can drill for water"

In fact there is a lot of water deep down in the desert, so much so that Libya made the "Man Made River Scheme" to pump the water from the desert to Tripoli and Benghazi.

company oil fields are fairly close, perhaps only 100km apart then motor vehicles are used. Before leaving one camp, your destination is radioed in and your ETA is given. Every vehicle is fitted with a two way radio and you always take plenty of water. The rule of Desert is that if you meet any vehicle that has broken down you always stop and make sure they have enough water. Sometimes, especially when dust and sand storms are around it could be several hours before someone would come out to find them. Driving in the Desert (I always had a driver to take me to wherever I needed to go) is not as hazardous as it might seem; where there is no 'black top' (metalled road), there are tracks which are easy to follow. As you tend to head directly to where you want to go, it is unlikely that you would get lost. I

Oil field camps – These are dotted all over the Desert serving the various oil fields there are tennis courts, swimming pool, social club a real holiday camp. Everyone has a Medical Centre, the main problem being sand in the eyes

The men working in the oil fields come from many counties around the world, the main languages spoken are English and of course Arabic. Only men work out in the oil fields, as a rule women are not allowed in camps. I believe this rule also applies in the UK to oil rigs in the North Sea. The men work a seven day week; many are on what is called a "five and three"; five weeks on then three weeks off back in their home country. Although the basic education is very good among the Libyans, they lack technical education hence there are a large number of "ex pats" in the oil fields. Ideally the Libya Government would like the oil companies to use the indigenous population, but at the moment the only way to train them is by apprenticeship i.e., working alongside the 'ex pats'. This method is not ideal because although they learn how to do the job, they are not necessarily taught the necessary academic background, hence when something unusual happens they do not have the knowledge to fathom out what to do. This became clear to me in the small oil field medical centres where perhaps there was only a Libyan male nurse in attendance.

During my first visit – I made the inventory of the medical equipment as requested and also serviced and repaired much of the equipment out in the "field". It was then agreed that I should make routine visits to Libya to continue the service and repair of the medical equipment for Veba Oil. Other oil companies heard of my service and employed me to work for them doing the same job. The normal way for men to move about between oil fields is by aircraft, however where two would stay just one or two days in each oil field before either flying or being taken by vehicle across the desert from one camp to another.

Driving in the desert is a beautiful experience; it is not by any means all sand dunes, in fact in northern Libya there are very few. As you enter the desert from the Mediterranean, there are large flat areas with only a few centimetres of sand on top of a hard earth surface. As you venture 100km or more into the desert, the landscape changes and large flat topped plateaus appear, with what appears to be large dried up water courses in between. In fact millions of years ago the whole area was covered by water, with islands and rivers forming the landscape. Now the water has gone, but it has left behind sea shells and petrified wood etc. In some places the petrified wood is so prolific the oil workers use it as door stops, ash trays etc.

Interestingly, each company is very secretive and will not allow vehicles from another company to visit their field. If I was going from one company to another in the desert, I would be taken by a 4x4 vehicle to the edge on the company field in the desert where we would wait until a vehicle from the other company would come and I would change vehicles.

I continued doing this work for a number of years and spent quite a lot of time in both Benghazi and Tripoli, the two main towns in Libya and travelling by road to the townships in between.

The people

To understand the Libyan people you have to look back at their recent history. For well over 100 years until the revolution in 1969, they were dominated by other nations. Initially it was the Turks and then in the earlier part of the 20th century by the Italians. After the Second World War they were occupied by the British and Americans. Until oil was found in the early 1960s, the Libyans on the coast were mainly farmers; in the Desert there were (and still are) nomadic tribes. When oil was found, it was extracted by foreign nationals with the Libyans mainly doing the menial tasks. The revolution in 1969 meant that Libya could be run by Libyans; the 25 year contracts on oil exploration did not expire until the late 1980s when the oil reverted to Libyan ownership. This was not popular with the western world, hence the bad publicity Libya received around this time.

Naturally I met and associated with many of the Libyan people – in the first instance only the men; it was not until much later that I had contact with any of their womenfolk. My impression of the Libyans is that they are extremely friendly and honest; almost you might say a childish innocence. In my many visits to Libya I do not think I have ever met an unfriendly or rude Libyan – I cannot say that of any other country I have visited. Contrary to popular belief the womenfolk are not treated any differently to that as in some parts of the UK. Although this is an Islamic country, the women are treated as equals, in fact in the universities many of the Heads of Departments are women. Their dress code is slowly changing to a more western style although the majority of women still wear shapeless dresses and head scarves. Material wealth in not important in Libya, outward opulence is unusual. Many of their cars for instance have seen better days; a Libyan treats his car like perhaps a farmer would treat his tractor; as long as it serves its purpose i.e. to get you from A to B it does not matter what it looks like. The roads are good but the standard of driving is rather poor by European standards. They mainly drive on the right-hand side of the road. There is an old saying "the Americans drive on the right side of the road, the British on the left and the Libyans on the shady side". Food is highly spiced and as with many Arab countries they favour meat and fish over vegetables. Of course pork is not eaten and there are no MacDonald's restaurants. There are however many very good restaurants in Tripoli and Benghazi. If you ask for steak and chips in a restaurant you are likely to get a steak weighing perhaps 500gm and about six chips (I have counted them on many occasions) and a couple of slices of tomato. There would however be a side salad and a number of 'dips'.

Racecourse in Tripoli

The actual course is sand not grass. It has two uses during the week, training the horses (they go clockwise on the inside) and a place where the locals can go jogging (they go anticlockwise round the outside). The women of course are fully dressed including headscarves when jogging.

Scientific education

Libya has never been an industrial nation; hence interest in science and technology as a profession was, until a few years ago, virtually none existent. Those who wished to become scientists, doctors or technologists had to do their training abroad. Obviously Libya wants to become self sufficient and therefore is now investing heavily in education. The other big change that is taking place is that it is trying to change from being basically a socialist country into a more capitalist one i.e. hospitals and universities are going to become self-funding rather than state controlled.

Over the past 10 years or so I have lectured there in schools, colleges and at one medical conference, where I was the only European. The fundamental education is very good; English is used as the main language for science subjects, however Libyan Arabic is the normal language of the country. Funding for education at present is very good and there is no shortage of good equipment both for teaching and for use in laboratories etc.

Pauline, my wife, talking to students at the College for Gifted Students (Sixth Form College). They wanted to know about life and fashion in the UK.

In May 2008 my wife and I were invited by the president of the newly formed Libyan International Medical University (LIMU) in Benghazi to visit the University and attend a board meeting with the Heads of Departments, to discuss the way forward in teaching subjects allied to medicine and Laboratory technology in areas such as Radiology, Ophthalmology, Chiropody, Medical laboratory sciences.

The idea is to start courses in many such subjects as well as training medical clinicians. Some courses would be in conjunction with the medical course whereas others would be separate and in some cases just short courses. The qualifications they wish to offer must be acceptable worldwide. The big problem at the moment is finding teachers/lecturers, many, in the first instance will have to recruit from other countries.

Another subject that is very important especially to me is the electrical and mechanical repair of equipment. In the UK, if a piece of laboratory equipment breaks down or requires a routine service or calibration, it is relatively easy to contact the manufacturer or one of their agents to get the work done. It is not so easy to send a technician all the way to Libya to do a routine service and it is certainly not cost-effective. What is required is to be able to train members of the indigenous population to do the job. A few years ago in the Medical College in Benghazi, I was asked if I could assemble some 35 microscopes for them. They were high specification Leitz microscopes that had been delivered in parts some ten years before and no one knew how to assemble them. They had been bought by a previous Director of the College and had been stored in a basement still in their original boxes.

I was given two workshop technicians who had never assembled a microscope before and as many porters as I required. I asked for a room to be set aside with tables positioned around the edge. I then asked the porters to unpack all the boxes and put parts that looked the same to be placed together on the tables.

We used a table in the centre of the room to assemble the microscopes. It did not take long to teach the two technicians how to assemble the microscopes and check them for correct illumination. I only had a couple of days to complete this task (there was a lot of other equipment to service and repair). In that time we had assembled about 20 of the microscopes and after I left I gather the technicians managed to assemble the remainder. It became obvious to me that given proper teaching, their ability to learn, bearing in mind the language difficulties, was considerable.

What is required is a basic technical knowledge of the subject and then how to understand the workshop manuals supplied with the equipment. Ironically I found sometimes the manuals had been lost because they were written in English and no one could understand them.

Whilst in Benghazi in May 2008, I also went to the Garyounis University, which is the main general University in the town. Here they are just starting courses in Science and Technology and are very interested in the concept of an Institute i.e. the IST to represent both science and technology. It has to be remembered that having institutes or societies or even unions is unusual in Libya; however having an organisation to represent technicians and technologists interests them.

Libya is an emerging country which is trying to get on terms with the modern Western World. It is rich because of its oil production. Surprisingly perhaps, its people are very keen to associate with the United Kingdom, and are arguably the best educated in Africa; their standard of living compares favourably with that in the UK. Medically their ratio of doctors and nurses to the population is as good if not better than the UK. The problem is that they are very short of trained technical staff in both the hospitals and the universities.

I have recently had talks at University College London and we feel it we should get together a small team to meet representatives of the Libyan Educational bodies either here or in Benghazi to see if we can formulate some sort of training programme.

AUTHOR

Derek Sayers FIScT MInstLM is the Fellowship and Overseas Secretary of the IST.

Ghana Science Technology Institute Report

Rosina K Nyarko ▶

Technicians & Technologists - Is There a Future for the Profession?

Science and Technology seem to be something that practitioners of science believe every immerging economy needs to revolve around to move forward. As such there is a need to train middle level personnel to help achieve such an objective.

Many developed countries have reached where they are only through the help of such personnel and Ghana, a developing country, is no exception to this ideological statement, but in reality little is being done to achieve this need. The industrialization processes embarked on by the first president Dr Kwame Nkrumah had the vision of self dependence for Ghana, and hence lots of senior high and technical schools were established to educate its nationals in this direction.

The polytechnics were one of such institutions and were established to absorb those students who could not enter universities due to one reason or the other, and to help give such technical and vocational training to enable them to work in the newly created industries. A few were given scholarships to train in the United Kingdom, Canada and mostly the Eastern European block countries.

Mission Accomplished?

Can one ask whether the vision of our dear president, may his soul rest in perfect peace, has been accomplished? Yes and no. Yes because so many jobs were created that gave employment and skill training to the low and the middle level personnel. Technicians/ Technologist were very much respected and held in high esteem because they had the skills, knowledge and expertise to work and achieve higher output. They also imparted knowledge in the form of practical skills to scientists in education, research and industry. Chief Technicians/ Technologists were on the same salary scale as a senior lecturer in our Universities. However, not long after the overthrow of Dr Nkrumah, things started to go slowly downhill, beginning in the 80's until now. Though there has been a significant increase in schools and polytechnics, standards have fallen because of there being little emphasis on practical work, although students are made to go for attachments in some institutions for practical work.

But one could ask how much practical experience will such a student acquire within 1- 3 months? Such institutions should have well equipped laboratories for students to learn with on a daily basis, but what we actually see is that those laboratories are ill equipped, making teaching and learning of science and related courses difficult.

The difference between technicians/technologists and a university graduate is often the ability for the former to perform better on the bench, but institutions are currently only giving basic theoretical knowledge to their students. Discrimination against technicians and a lack of further training is also adding to the problem, resulting in a lack of interest in the technical profession.

The IST Higher Diploma Training Scheme came as a relief to most of us and after going through the requisite course work, passing a set examination and project, one could think of promotion and further education. The problem in Ghana is that most of the premiere universities have refused to recognize the IST Higher Diploma as an entry to do a degree courses let alone postgraduate courses.

Even those of us who were fortunate to be accepted to do a science Masters programme in the United Kingdom or Japan, just to mention two, and are working in school and research laboratories also are faced with placement problems. Coupled with lack of recognition, the new trend is one cannot ask for study leave, the requirement to qualify for such a study leave has been made so complicated that it will take ages to be granted if at all. Though various Heads of Institutions will approve of such training the central administration puts impediments in their way. I have personally noted the case of a colleague who was offered admission by the University of Surrey to read a Masters in Microbiology but was refused sponsorship by the mere fact that he doesn't hold a first class degree. This after the head of his department, having realized the importance of technical training, had given the necessary recommendation to enable this technologist to acquire further knowledge and technical skills to enable him contribute to both teaching and research.

Staff in the Humanities notably, can progress to whatever level they wish but the science technicians are least looked after. At the moment in the University of Ghana where I work there is no training for technicians. Efforts made to change this trend have fallen onto the deaf ears of the authorities. Without technicians and technologists, teaching and learning of science would not be achieved, a highly trained technician/ technologist enhances the lecturer's work. After theoretical knowledge the students need the practical aspects to understand the subject better.

In developed countries technicians and technologists are highly rated because of the role they play in both research and teaching, one can see a technician who holds a doctorate degree and still continues to work in the laboratory. What we see in developing countries like Ghana is that PhD holders are mostly lecturers, and only a very few are seen in the laboratories and on the bench involved in research. The onus now lies on the technicians and students to work hard to produce results

for these researchers to enable them to write papers for publication. All these factors coupled with low incomes and remunerations have contributed to the loss of interest in the profession. People with the same level of professionalism working in private sectors are receiving five times higher salaries than those in the public sector institutions.

The Solution

In my opinion the solution to this problem is for our leaders, both in government and academia, and all other stake holders in education, to sit up and adopt strategies that will change this social injustice. The perception that only holders of first degrees are considered relevant should change, there is no doubt that the private sector employers have seen these anomalies and rather prefer employing applicants with professional qualifications.

One could find a first class graduate, who cannot perform adequately on the bench, to be the boss over a technician/ technologist in a research institution for the mere fact the latter has no degree to show for their immense experience and technical skills, which actually make them more competent on the job.

Recognition should be given to those people with competency on the bench and job, alongside promotion and appropriate remuneration to encourage new and to maintain our existing technical staff especially in the Universities, research and industries.

Catching Them Young

Young people these days see the learning of science and mathematics as difficult subjects, so it's time to go to the schools and disprove this perception. The Science Workshop for Girls, that was constituted by Prof. Marian Ewurama Addy in collaboration with the Ministry of Education, contributed to the high number of girls opting for science courses in our high schools.

I can attest to the fact that most of the girls who pursue a degree in biochemistry are doing very well, most are getting first class honours etc. The same can be done in the less endowed schools to mentor them if they fail to make grades to the universities. They could opt for courses in technology such as the Science Laboratory Technology, Medical Laboratory Technology and Dispensing Technicians being offered by some Universities and Polytechnics, even to the bachelor of technology level.

In view of these the Ghana Science Technology Institute (GSTI) has taken the initiative to adopt and mentor some senior high schools. One of such is the St John's Grammar Senior High School, a school that was built and managed by a private entrepreneur fifty years ago as a business school. Later other courses namely science, general arts and home economics were added. The school has been taken over by the government of Ghana to help in its management and infrastructure development so as to enable a higher intake of students to serve the community and adjoining ones. The schools started as a day school but later boarding facilities were developed and these led to an increase in number of students coming from other regions.

The school can now boast a student population of one thousand five hundred, but little has been seen in terms of infrastructure such that classrooms, dormitories and laboratories are woefully inadequate.

Since the school was originally a business school, emphasis has not been laid much on science therefore the Ghana Science Technology Institute saw it wise to come to its aid. The association gathered varieties of laboratory wares and donated them to the science department to argument their needs and also pledged to help re-train the technical staff and in teaching some parts of the subjects. The items include test tubes, pipettes, volumetric flasks, test tube racks and holders, beakers, conical flasks, pipette fillers/bulbs, etc. all valued over £10,000.00 on 12th November 2009.

Presentation ceremony that took place in November 12th 2009 in Ghana

It is the hope of the Ghana Science Technology Institute that the school will be among the best schools offering science in Ghana. We are of further hope that giving such assistance will encourage the students to opt for science related courses to help train more scientists, technicians and researchers whose research works will advance science in our country.

Once again the GSTI is re-visiting its request made some years back to institutions and IST members who have various working and usable equipment to donate to us to help in this genuine cause. On the following page is a list of equipment and chemicals that will be of immense benefit to us.

List Of Equipment Request Gsti 2010

1. Spectrophotometers Double Beam UV/Visible
2 Spectrophotometers Single Beam UV/Visible
3. Ultra High Speed Refrigerated Centrifuge
4. High Speed Refrigerated Centrifuge
5. Bench Centrifuges
6. Drying Cabinets
7. Ovens (Hot air/ Drying ovens)
8. Incubators
9. Magnetic Stirrers/Hotplates
10. Magnetic Stirrers
11. Hotplates
12. Orbital Shakers
13. Reciprocating Shakers
14. Autoclaves (Front/ Top Loading)
15. Bench Colony Counters
16. Hand-held Colony Counters
17. Blenders/Mixers
18. pH Meters with Electrodes
19. Thermostatic Water Baths
20. Boiling Water Baths
21. Magnetic Stirrers/Flees
22. Dispensers/Pipette Fillers (automatic/manual)
23. Shandon Chromajar CJ110-10 (Cylindrical glass chromatography tanks, 28 x 13cm H x diameter with a 16cm gallery at the mouth).
24. Vacuum Pumps
25. Peristaltic Pumps
26. Permutit Regenerable Deionisers
27. Water Distillation Units
28. Freeze Dryers
29. Ice-Makers
30. Circulating Chiller Units
31. Compound Microscopes
32. Quadrants
33. Sweeping Nets
34 Pooter
35. Photometer
36. Butterfly nets
37. Anemometers
38. Rain gauges
39. Wind vane
40. Petri Dishes (glass)/Disposable
41. Hand lenses
42. Microscope slides
43. Dissecting Kits
44. Biological Charts
45. Beakers (50, 100, 250, 1000 etc.) mls
46. Conical flasks (various volumes)
47. Burettes,
48. Pipettes
49. Weighing Balances (Analytical/Beam)
50. Funnels
51. Wash bottles
52. Thermometers
53. Tripod Stands and Clamps
54. Benson burners
55. Test tubes/Test tube racks
57. Meter bridges
58. Potentiometers
59. Sonometers
60. Tuning Forks
61. Voltmeters
62. Rheostats
63. Ammeters
64. Galvanometers
65. Rectangular glass prisms
66. Triangular glass prisms
67. Concave lenses and mirrors
68. Convex lenses and mirrors
70. Accumulators
71. Stopwatches
72. Fume Cupboards
73. Pipette Washers
74. Viscometer
75. Hydrometer
76. Safety Cabinets (Class 1&11)
77. Staining Dyes (Eosin, Methylene Blue/ Green, Sudan 111, Sudan Black, Iodine Crystals, Thionin, Phloroglucinol and Aniline Blue)
78. Specimen Preservation Chemicals (Formaldehyde)
79. Reagents and Chemicals/ Solvents:
80. Sodium Chloride, Sodium Sulphate, Sodium Carbonate
81. Calcium Chloride, Calcium Carbonate, Copper 11 Sulphate, Calcium Hyroxide
82. Silver Nitrate, Ammonium Sulphate, Ammonium Chloride
83. Ferric Chloride, Ferrous Sulphate,
84. Acetone, Acetic Acid, Chloroform, Ethanol, Methanol, Hydrochloric Acid
85. Sulphuric Acid and etc.,

AUTHOR

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Selection of Active Air-samplers

Tim Sandle ►

Introduction

Viable microbiological environmental monitoring is a key aspect of any sterility assurance programme in order to assess the number of viable micro-organisms present. A viable environmental monitoring programme requires the use of a range of different techniques. These can be divided into air-samples, surface samples and personnel samples. Air-samples include both passive (settle plates) and active (using a sampling device) (Ackers and Agallaco, 2001).

One of the more difficult choices facing an organization is which type of active air-sampler to select. The use of active air-samplers is highlighted by the FDA (in the 2004 Guide to Aseptic Filling) and in the international cleanroom standard for biocontaminaiton control: ISO14698-1, as being of fundamental importance to any environmental monitoring regimen. Active air-samplers allow the number of micro-organisms in a given volume of air or measured over a set period of time to be captured onto a microbiological culture medium and then to be enumerated. Micro-organisms are not evenly distributed in air and several factors like moisture, temperature, electrostatic charge, light, air movement, and so on, influence the distribution. There are many variations in the type of active air-sampler and in the efficiency of different models. No single model or type has universal acceptance and each model has strengths and weaknesses. This paper details some of the variations associated with active air sampling, with an aim in guiding the reader into making an informed choice.

Active air-sampling

Active (or volumetric or bioaerosol) air samplers are a slightly different measure of micro-organisms in air than settle plates. The settle plate indicates the number of micro-organisms that may deposit onto a surface; the active air-sampler indicates the number of micro-organisms present in a given volume of air within the range of the air-sampler. Both of these approaches have merits and any comprehensive programme will use both active air samples and settle plates.

The volume of air sampled is normally one cubic metre of air. Therefore, like the settle plate, the data can be quantified. Within a Grade A (ISO 5) clean room environment the number of micro-organisms present would be expected as <1 cfu / m^3, therefore the efficiency of the sampler is of great importance.

There are some variations with all types of active air sampling. These include:

- The non-random distribution of micro-organisms in the environment;
- Imprecision in the various sampling techniques;
- The rate of sampling. At lower velocities there is a danger that micro-organisms will not be deposited onto the agar medium, whereas at higher velocities there is a danger of desiccation of the culture medium.

These variations must be considered when choosing between different sampler types and models (Buttner, M. P. and Stetzenbach, 1993).

Types of active air-sampler

The type of air-sampler used has an important bearing on the data. There are limitations with accuracy and recovery when selecting between air-samplers and there is no one model on the market that overcomes all of the difficulties. In examining different models, the first problem is that the results from different types of model (especially those using different sampling techniques) are not comparable. There are also competing ways to validate the samplers.

There are three main types of active air-sampler: impaction, centrifugal or filtration. However, other types of sampler are available. In assessing the three main types, an impaction air-sampler functions by accelerating air, at an angle of 90°, through holes in the head of an air-sampler (often a 'sieve like' design) and impacting any micro-organisms onto an agar strip or plate. A centrifugal air-sampler draws air into the sampler head through a rotating vane mechanism. The vane causes micro-organisms to be thrown out of the air and onto the agar through the effect of the centrifugal force[1]. For filtration air-samplers air is sucked through a filter and any micro-organisms are captured onto a membrane filter which is then transferred to the surface of a culture medium and this is then incubated.

Effective air-samplers must be able to precipitate particle sizes of at least 2μm (De Abreu *et* al., 2004). In relation to most cleanrooms particles sized 5μm or larger are more meaningful. This is because most airborne micro-organisms are typically between 5 – 15μm and increase to15 – 18 μm for naturally occurring airborne particles, like skin flakes, which contain bacteria (Meir and Zingre, 2000; Kaye, 1986). There are also differences in the sampling volumes of different model samplers, with most models capable of sampling at least 1000 litres.

There is considerable debate within literature as to which type of air-sampler is the most efficient. The most common types of air-sampler and the methods of operation are:

- Slit-to-Agar Air Sampler (STA) – the air is drawn by a self-contained vacuum pump through a standardized slit below which is placed a slowly revolving Petri dish containing agar. Particles in the air that have sufficient mass impact on the agar surface. The agar plates are incubated and viable organisms are allowed to grow out.
- Sieve Impactor – the apparatus consists of a container designed to accommodate a Petri dish containing agar. The cover of the unit is perforated, with the perforations of a predetermined size. A vacuum pump draws a known volume of air through the cover and the particles in the air containing micro organisms impact on the agar medium in the Petri dish. Some samplers are available with a cascaded series of containers containing perforations of decreasing size.

The above two methods allow the determination of the distribution of the size ranges of particulates containing viable microorganisms based on which size perforations admit the particles onto the agar plates. Other air-sampler types include:

- Centrifugal Sampler – the unit consists of a propeller or turbine that pulls a calculated volume of air into the unit and then propels the air outward to impact on a tangentially placed nutrient agar strip set on a flexible plastic base.
- Sterilizable Microbiological Atrium – the unit is a variant of the single-stage sieve impactor. The unit's cover contains uniformly spaced orifices. The base of the unit accommodates one Petri dish containing a nutrient agar. Air is drawn through the unit by vacuum and allowed to impact on the agar surface.
- Surface Air System Sampler – this integrated unit consists of an entry section that accommodates an agar contact plate. Immediately behind the contact plate is a motor and turbine that pulls air through the unit's perforated cover over the agar contact plate and beyond the motor, where it is exhausted.
- Gelatin Filter Sampler – the unit consists of a vacuum pump with an extension hose terminating in a filter holder that can be remotely located in the critical space. The filter consists of random fibers of gelatin capable of retaining airborne microorganisms. After a specified exposure time, the filter is aseptically removed and dissolved in an appropriate diluent and then plated on an appropriate agar medium to estimate its microbial content. The filter may also be plated directly on an agar surface.

In addition to the wide choice of various sampler types different models of air-sampler vary in their efficiency. Some devices themselves can generate non-viable particle counts, and this should be considered in the design qualification of such devices. Other design considerations include the suitability of the sampler to any sanitisation procedure for equipment to enter the clean room and the sampler's operation as an isokinetic sampler (that is to match the airflow speed within the UDAF).

1 **Definition**: "An object travelling in a circle behaves as if it is experiencing an outward force. This force, known as the centrifugal force, depends on the mass of the object, the speed of rotation, and the distance from the centre. The more massive the object, the greater the force; the greater the speed of the object, the greater the force; and the less distance from the centre, the greater the force". (from www.phunphysics.com)

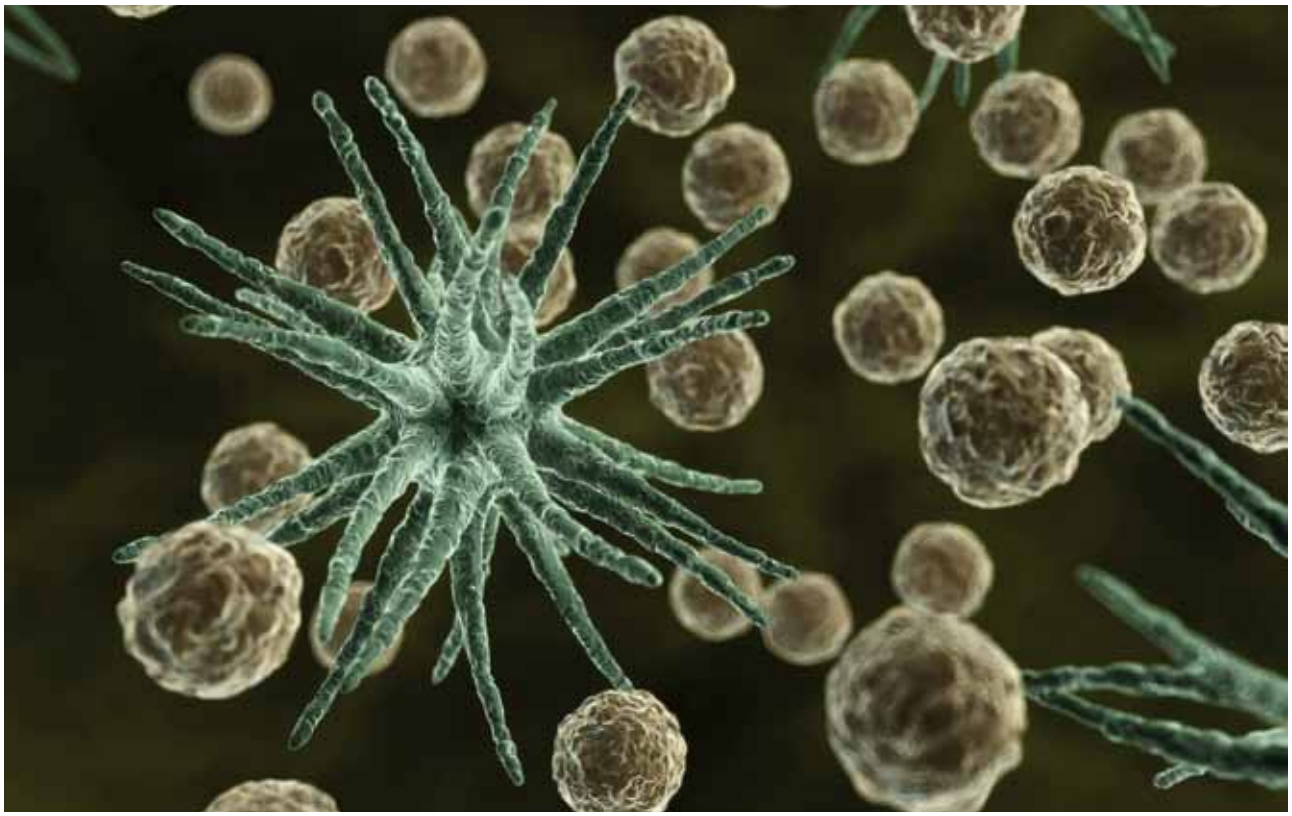
Table 1: Summary details of different types of air-sampler and the comparative advantages and disadvantages of each.

Note: These are some of the more common manufacturers of air-sampler in the pharmaceutical industry. There are other manufacturers and the listing of selected models is intended to be illustrative and not an endorsement of any particular supplier or model.

Model	Description	Advantages	Disadvantages
Sieve impactor	A vacuum pump draws air through a sieve-like (perforated atrium) head (the perforations are of a predefined size and are uniformly spaced). As air is drawn in, the units in the air impact onto an agar medium placed in the sampler (normally a Petri-dish of 55 mm size). The exhaust forces the sampled area, after the initial impaction, through 90° and any micro-organisms are deposited onto the agar. The air is exhausted from the rear.	• High capture efficiency. • Convenient. • Portable and flexible. Self contained power supply. • Perforated cover plate can be steam sterilised. Can measure large volumes of air. • Use standard 'contact plates'. • Airflow can be calibrated.	The high air-velocity can affect microbial viability.
Slit-to-agar sampler	This model was one of the earliest active air-samplers, pre-dating the centrifugal air-sampler (below). These samplers use a vacuum to draw air in through a standardised slit. Below the slit is a revolving agar plate or strip (normally a 150mm plate). Units in the air, of sufficient mass, impact onto the agar. The speed of the plate / strip rotation, and the volume of air sampled, can be adjusted.	• Measures large volumes of air. • Small size allows relatively easy placement in small areas. • Entire sampling unit can be steam sterilised. • Air-fow can be calibrated.	The main disadvantage with this type of sampler is that their portability is limited. It also requires a vacuum source.
Filter air-sampler	The unit consists of a vacuum pump and extended sampling hose. Air is drawn through the hose towards a filter. The filter is designed to retain airborne micro-organisms in a gelatine matrix. After a specified exposure time, the filter is removed and placed onto a Petri-dish (normally a 90mm size plate). The main disadvantage with the conventional filter air-sampler is the possibility of desiccation of micro-organisms. The concerns about the death of micro-organisms through desiccation on the filter membrane can be overcome by the use of a gelatine filter. This filter dissolves when placed onto an agar plate during incubation. An advantage of this type of air-sampler is that the air-flow rates can be adjusted and therefore isokinetic sampling can be achieved.	• Measures a large volume of air. Has high capture efficiency. The use of the gelatine filter can overcome desiccation of some collected micro-organisms. Filter holder can be sterilised. Small size allows relatively easy placement in small areas. Airflow can be calibrated.	Membrane must be placed on a nutrient medium before enumeration. The gelatine filter is relatively fragile.

Model	Description	Advantages	Disadvantages
Centrifugal sampler	The unit consists of a propeller that pulls a known volume of air into the unit, towards the impeller blades. The air is then thrown outward, through a turn of about 360°, so it impacts onto an agar plate or strip (strips are more common). Due to centrifugal forces (typically 4014 to 4178 revolutions per minute), any micro-organisms in the air deposit onto the agar. The 'standard' device is the Reuter Centrifugal Sampler (RCS). This was the 'second generation' of air-samplers. Several independent studies indicate that the centrifugal air-sampler is the most efficient method[2]. However, there are limitations with the method and some doubts about whether it is capable of collecting all unit sizes which might carry airborne micro-organisms. The instruments also tend to require frequent calibration of their sampling heads.	• Measures a large volume of air. Has high capture efficiency. The use of the gelatine filter can overcome desiccation of some collected micro-organisms. Filter holder can be sterilised. Small size allows relatively easy placement in small areas. Airflow can be calibrated. • Convenient. • Portable and flexible. • Self-contained power supply. Head assembly can be steam sterilised.	Single source of agar strips. More handling involved by inserting and removing agar strips. Potential disruption of air-flow, especially in UDAFs.

When selecting an air-sampler and in determining the approach to air-sampling, the user should be prepared to justify the choice to a regulator. Devising a type of questionnaire is one approach. This is particularly useful for developing a User Requirement Specification (URS) or during the Design Qualification (DQ). To make an assessment the following questions could be considered:



2 For example, Delmore and Thompson, 1981

Table 2: Considerations for purchasing an air-sampler.

Question
What is the mode of sampling?
What is the time period needed to take an appropriately sized sample?
Does the device have a suitable flow rate to collect 1m^3 within the required time?
What effect will the air-sampler model have on the air-flow pattern? (if applicable)
What effect will the sample rate have on the air-flow pattern? (if applicable)
Is the method sufficiently sensitive enough to detect low levels of contamination?
Does the dehydration of media have an effect on the recovery of contaminants?
Can the instrument access all of the planned sample sites?
Can the instrument be used remotely?
Is the unit portable?
What is the purchase cost and operating cost of the instrument?
Is the culture media used unique to the instrument?
Is the construction of the instrument compatible with disinfectants and cleaning regimes?
Can the air-sampler head be sterilised?
What happens to the exhaust air of the sampler and where is it discharged?
What does the literature review indicate for the sampler efficiency?
What impact does the unit size have on the efficiency of the sampler?
Has the manufacturer determined the biological efficiency of the sampler using a range of micro-organism types using a standard aerosol test?
Has the supplier carried out equivalence tests against other commercially available samplers?
Has the effect of dehydration of media been examined after the maximum sampling time?

The practical use of active air-samplers

There are a number of important issues to consider when using active air-samplers, especially in critical zones. There are arguments against and in favour of active air samples in the Grade A / ISO Class 5 environment. This debate centres on the disruption of the air-flow caused by the operation of the air-sampler. The number of active air-samples taken during a session should be considered. The affect of the air-sampler can be examined through air-flow visualisations studies where the disruption of the air-flow can be visualised by smoke studies (at a time when the clean room is decommissioned).

Furthermore, the act of placing and removing an active air-sample is an intervention into the environment and this must be carefully practiced during media simulation trials or during practice sterility testing sessions. Due to this, where Isolators are being monitored, many users have fitted the active air-sampler outside of the Isolator environment. This is achieved by feeding a length of tubing into the Isolator, so that air can be drawn out and into the sampler. This is a similar concept to the placement of many particle counters and reduces the risks associated with intervention. The user may also wish to consider the ease of cleaning air-samplers and the reaction to the air-sampler material to different disinfectants.

Some organizations have performed studies in order to determine if the active air-sampler itself generates particle counts in addition to the disruption of the airflow. Most models of active air-sampler will generate some level of particles. The key concern is if these are at a level that could be detected by discrete particle counters and therefore generate 'false' count data when processes are being monitored.

A further area of consideration is the effect of dehydration on the culture media used in the active air-sampler. This is an area that organizations may need to examine for themselves because the rate of moisture loss will relate to the type of culture media used (and the fill volume). It will also depend upon the incubation conditions, times and

temperatures. Such studies should be performed post-incubation and use a range of micro-organisms with which the growth promoting properties of the culture medium should be assessed. It is common to include isolates from the manufacturing facility in such studies.

Qualification and Calibration

As indicated earlier it is important that air-samplers are qualified before use (through the standard DQ, IQ, OQ and PQ route) and are calibrated on a regular basis. The common method for calibration is using a certified anemometer. It is common for samplers to become less efficient over time (in terms of air volume and flow rate). This can trigger the need to re-assess previously gathered data if the sampler has been over or under-sampling outside of defined tolerance levels.

Therefore, the selection and operation of active air-samplers involves complex choices, including: the ease of use; the universality of application; resistance against cleanroom disinfectants; the battery life; speed and collection efficiency; timer delay and the ability to adjust and to calibrate the device.

Validation of active (volumetric) air-samplers

Like all critical items of cleanroom monitoring equipment, air-samplers require validating (Nobel, 1993). Whether this is undertaken by the manufacturer or by the user is a decision to be made. Microbial air samplers collect a predetermined volume of air and impact micro-organisms against agar-based growth medium. Once the sample has been collected and the medium incubated, the results are typically expressed in colony forming units per cubic meter (cfu/m^3).

The assessment of air-samplers is very complicated and many of the aspects of the sampler's operation are best left to the manufacturer to establish and for the user to then evaluate and audit against, rather than attempting to replicate aspects of the operation in the laboratory. In addition the unit which examines microbiological methods has indicated that each of the different models of air-sampler has operational disadvantages: there is no ideal air-sampler on the market.

The user should, prior to purchasing an air-sampler, list out those aspects of operation that might introduce a degree of variability into the test:

a) Ability to be sterilised;

b) Sampling efficiency;

c) Disruption to uni-directional air-flow;

d) Physical parameters.

Of these the most important is the flow rate. The flow rate accuracy for the different models of air samplers varies by manufacturer; the specifications can range from +/-2.5% to +/- 10% of the volume collected, depending upon the model. In critical environments such as clean rooms, the sampling times are typically a full cubic metre of air and the counts are very low. In this environment, accurate sample collection is important. Assuming a sampling volume of 1000 litres (m^3) the difference in collection accuracy is as follows:

- At ± 2.5% accuracy the variance in the volume collection is ± 25 liters of air.
- At ± 10% accuracy the variance in volume collection is ± 100 liters of air.

This is a difference of ± 75 litres of air in overall volume collection accuracy between different models. It is possible for the target organism to be missed by the instrument with lower accuracy. Flow rate accuracy should be considered based on the manufacturing environment when choosing a system.

A further important aspect of the physical operation of an air-sampler is the relationship between sampling time and sampling volume. When comparing two different air samplers with different flow rates, the results can vary depending on whether the same air volume or the same total sampling time is used for both devices; the total sampling time rather than sampling volumes should be identical. To ensure equivalent representative samples, both units must be set to start and stop at the same time. Once the plates are read the results can then be multiplied to get to cfu/m^3. When running systems with the same flow rates, identical sampling volumes may be used.

a) Culture media will perform differently according to the sampling mode;

b) During aerolization microbial damage can occur. This is dependent upon the type of micro-organism among other factors;

c) The impact velocity can, where excessively high, cause metabolic and structural damage of the micro-organisms;

d) The variations are caused by different environmental factors, such as, air temperature, pressure, moisture content, wind speed, and turbulence;

e) Other considerations include: ease of use, reliability, functionality, overall cost, durability, portability, battery life, ability to be cleaned and sanitized, diagnostics, and ability to maintain consistent flow rates while avoiding leaks also should be evaluated when determining which air sampler to use.

ISO 14689 provides guidance on the selection and validation of air-samplers. The key validation factors are the 'physical efficiency' (the ability of the sampler to collect airborne particles, as described above, which has been demonstrated to decrease as the size of the particles decrease. In this context most samplers work best when detecting particles of 5 μm or larger[3]) and the 'biological efficiency' of the sampler (Andersen, 1966). The biological efficiency is the ability of the sampler to retain viability of the micro-organisms during the collection process so that they form visible colonies on the culture medium for counting purposes. A related issue is the ability of different samplers to retain different sizes of particles. This assessment requires specialised equipment in order to generate bioaersols (such as a Collinson spray) and testing requires the use of a Class III microbiological safety cabinet.

A second important assessment issue relates to high velocity air speeds which can stress vegetative cells and reduce the likelihood of cell viability. In contrast, low velocities reduce the collection efficiency of the

samplers. Some form of 'trade off' between these two factors is often required. Furthermore the air speed can increase the dehydration of the culture media used in an air-sampler (to the extent that the moisture loss from agar used in air-samplers is apparently faster than that of the exposed settle plate).

The user can carry out some form of laboratory assessment by conducting inoculation challenges onto the culture medium (either pre- or post-sampler operation). This can be coupled with measurements of weight loss and is similar to the studies on settle plates described above. There is considerable variation with the amount of water loss between different culture media used in different air-samplers, which can be as great as 40% (a phenomenon which increases with the age of the agar).

Compressed gas sampling

For compressed gas sampling, specialised air-samplers are required in order to conduct the monitoring, as the gas needs to be drawn at a fixed flow rate in order to sample a cubic metre of air. Monitoring is normally performed at a lesser frequency than for typical viable monitoring of rooms. Compressed gasses include sterile compressed air lines and nitrogen.

Summary

This paper has indicated some of the different types of active air-sampler that are available and has highlighted some of the areas that need to be considered when choosing between different models. The aim of this paper was not to endorse any particular type or model but to highlight some of the factors that are to be considered. Different manufacturers have published data relating to the efficiency of different samplers. These reports cover aspects like sensitivity, range and repeatability of the different models.

The paper has also raised some of the practical in-use concerns that need to be considered when using active air-samplers in cleanrooms. These various factors must be considered by the user and it is increasingly expected by regulators that these various options are captured in a documented rationale.

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2 A study by Benbough et al (1993) indicated that the collection efficiency for 4 μm particles decreased by 50% when a similar number of 1 μm particles were sampled.

Restoration of a Nineteenth Century FitzRoy Barometer

Kevin Scott ▶

Admiral FitzRoy has a deservedly honoured name in the history of barometers and weather observation and forecasting. Indeed, it may be said that he is the father of the science of Meteorology as we know it today. His wide experience as a sea captain and global explorer, his creative intellect and his keen powers of observation and measurement combined with a commitment to the welfare of seafarers and fishermen, led him to realise and exploit the measurement of barometric pressure for the prediction of storms for the preservation of life and the protection of shipping.

FitzRoy pioneered the interpretation of barometric observations and did much to equip sea ports and fishing harbours with the necessary instruments to make those interpretations possible. The history of this achievement has been well recorded by Collins[1] and it is not surprising that such a career gave rise to Fitzroy's name being attached to thousands of barometers. Some such instruments were those he enabled to be distributed to coastal locations, some were of the same design and quality, but sold and bought on the open market, and some were inscribed with FitzRoy's name and carried his 'remarks', but otherwise had little to do with him. Many of these barometers were manufactured throughout the latter part of the Nineteenth Century and into the Twentieth, and, being mass-produced, were not always of very good quality, and certainly not very accurate. Collins points out that the craftsmen who made them may have had little technical understanding of what they were making: the length of the barometer tube, and indeed, the whole instrument can be somewhat too short and the scale necessarily positioned to give an inaccurate reading.

The instrument that is the subject of the restoration described here is of such a class. It looks quite presentable, but the distance from the base of the glass mercury cistern to the scale is a half of one inch too short, so that the instrument cannot be properly set up for use at sea level. This disadvantage was alleviated somewhat by the fact that it is intended for present use at an altitude of 580 feet above sea level, which made it possible to adjust the mercury level in the cistern so the instrument would be corrected for pressure at sea level.

1. The Case

Figure 1 shows the overall instrument. The glass front slides in from the bottom along grooves in the side plates and is retained by the base of the instrument via two woodscrews securing the base to the case. Removing these screws allows the base and glass to be removed. The glass front had a semicircular top edge which fitted behind the carved top. In the present case the glass was intact and so only required cleaning. It was, however, thin Victorian glass and showed some minor casting defects, so it was handled with considerable care.

The storm glass, which was empty of fluid, the thermometer which was intact, and the barometer tube which was devoid of mercury were all removed by carefully prising out the brass pins used to secure them. These pins were polished and lacquered and set aside. With the instrument components removed, the condition of the scales and interior woodwork could be examined. The scale behind the stormglass had been very adversely affected by the storm glass contents which had leaked out all over it, reducing it to a friable, powdery condition from which it could not be retrieved. It was carefully copied and a replacement made. The main scale was in better condition and certainly worth preserving, but was very darkened by age and not very easy to read. It was resolved to leave it in place untouched, and to install a replacement in such a way as to preserve the original (i.e. without glue). It turned out rather easy to do this as there were thin wooden fillets lining the frame which could be used conveniently to secure the new scale. The new scale is shown installed in Figure 2.

Figure 1.
The restored Fitzroy Barometer

1 Collins, P. (2007), *FitzRoy and his Barometers*, Baros Books.

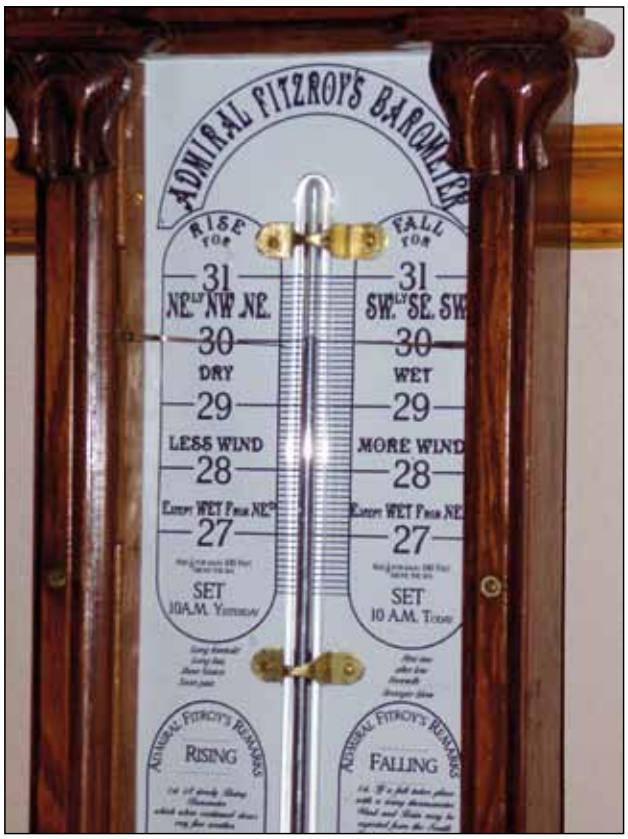


Figure 2. The scale

2. The Brass Components.

These comprised the pins, the saddles securing the glass parts, and the index mechanisms on each side for recording readings. The pins and the saddles were cleaned, polished and lacquered. The index mechanisms needed some further work. Figure 3 shows how they function. The pinion, shown removed from its slot in Fig 3, was a brass 10-leaf clock pinion, filed to a 1.75mm square section at the upper end and turned to form a blunt pivot at the lower end. It is introduced into its slot from the rear of the instrument and retained there by a thin steel plate perforated with a hole to fit the blunt pivot and having two other holes through which screws held the plate to the case. In the subject instrument, these plates had become completely corroded and had broken with the consequent loss of the right hand pinion altogether. A replacement was fashioned from a 10-leaf pinion blank obtained from skeletonclocks[2]. Two replacement steel plates were fashioned for the rear of the instrument and these were made in 0.5mm stainless steel sheet to prevent a repeat of the problem.

3. The Storm Glass

The author is entirely unconvinced that the storm glass has any reliable merit for weather observations and the most that can be said for it is that it represents a very crude thermometer. However, it is a historical component of the subject barometer and was restored using the mixture advocated by Negretti and Zambra. This consists of 2.5gm of potassium nitrate and 2.5

Figure 3. The Rack and Pinion index mechanism

Figure 4. The Storm Glass in position

grams of ammonium chloride dissolved together in 33ml of distilled water. To this solution is carefully added a solution of 10gms of natural camphor in ethanol. According to some reports, natural camphor 'works' better than synthetic because the latter contains borneol which has an adverse effect. The mixing of the solutions produces an immediate white precipitate of camphor which redissolves on warming. The storm glass tube, shown in Figure 4, was washed with detergent and filled with concentrated nitric acid and allowed to stand overnight. It was then rinsed with distilled water, allowed to drain and filled with the warmed storm glass mixture. It was securely corked. As the mixture cooled a voluminous white precipitate formed filling most of the tube and this slowly subsided to occupy less than half the tube over a period of days.

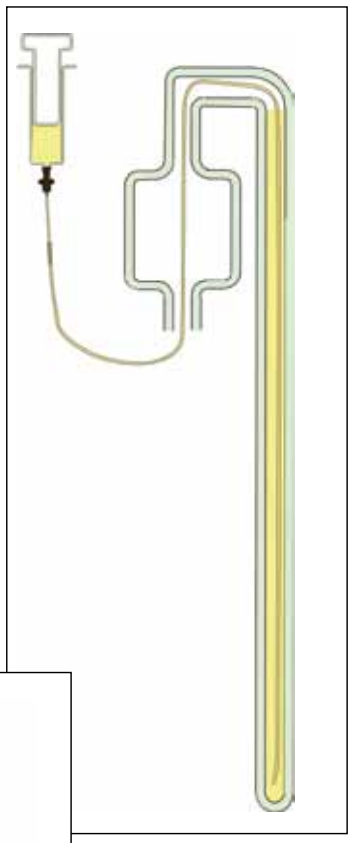
4. The Thermometer

The Thermometer is shown in Figure 5. It is an attractive instrument, mounted on hardwood (beech?) with a grained ivory scale. The bulb is pear shaped. Apart from cleaning and polishing the saddles, no other restorative work was carried out.

Figure 5. The Thermometer

2 Skeletonclocks. www.skeletonclocks.eu.com

Figure 6. The Barometer Tube cleaning apparatus



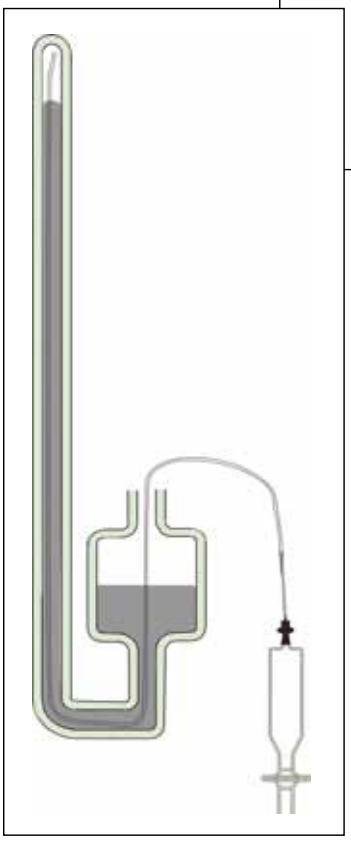


Figure 7. The Barometer Tube filling apparatus

5. The Barometer Tube

The Barometer tube was cleaned by filling it with concentrated nitric acid to remove all mercury and mercury oxide residues using the apparatus in Figure 6. A Teflon tube 1mm ID and 1.6mm OD was threaded to the far end of the barometer tube which was then clamped vertically upside down. The Teflon tube was attached to a glass syringe filled with nitric acid and the barometer tube completely filled and left to stand overnight. The nitric acid was then withdrawn and the barometer tube set upright and a further quantity of nitric acid allowed to remain for some hours in the cistern and U tube. The acid was then withdrawn and the barometer tube washed thoroughly with water and then rinsed with acetone. It was then pumped down to 50 microns of mercury pressure by means of a good rotary vacuum pump and left under vacuum for four hours.

Figure 7 shows the apparatus used for filling the barometer tube with mercury. Again a Teflon tube 1mm ID & 1.6mm OD was used and threaded to the top of the barometer tube, the latter clamped upright. A glass stopcock sealed to a borosilicate syringe barrel was used to connect the free end of the Teflon tube to the vacuum line. Clean, doubly vacuum-distilled mercury was poured into the cistern and the stopcock opened to the vacuum line. The mercury was pulled up the barometer tube to the barometric height. Thereupon the barometer was pumped continuously for 3 hours to achieve the best possible Torricellian vacuum in the finished instrument. The stopcock was then closed and immediately the Teflon tube was withdrawn from the barometer tube, filling the syringe with mercury in the process. The barometer tube was checked for the correct height at the prevailing atmospheric pressure.

6. Assembly

The installation of the barometer tube, the securing of it with the brass saddles and the final installation of the glass front and base was straightforward but great care was needed to maintain sufficient vertical orientation of the barometer tube to prevent any compromise of its vacuum. Rapid movements had to be avoided to prevent the mercury striking the top of the barometer tube with any significant force.

The barometer reading was adjusted to that of sea level by adding or removing mercury from the cistern.

The instrument was provided with two-hole brass wall plate by which it could be suspended on a wall a height convenient for reading the pressure.

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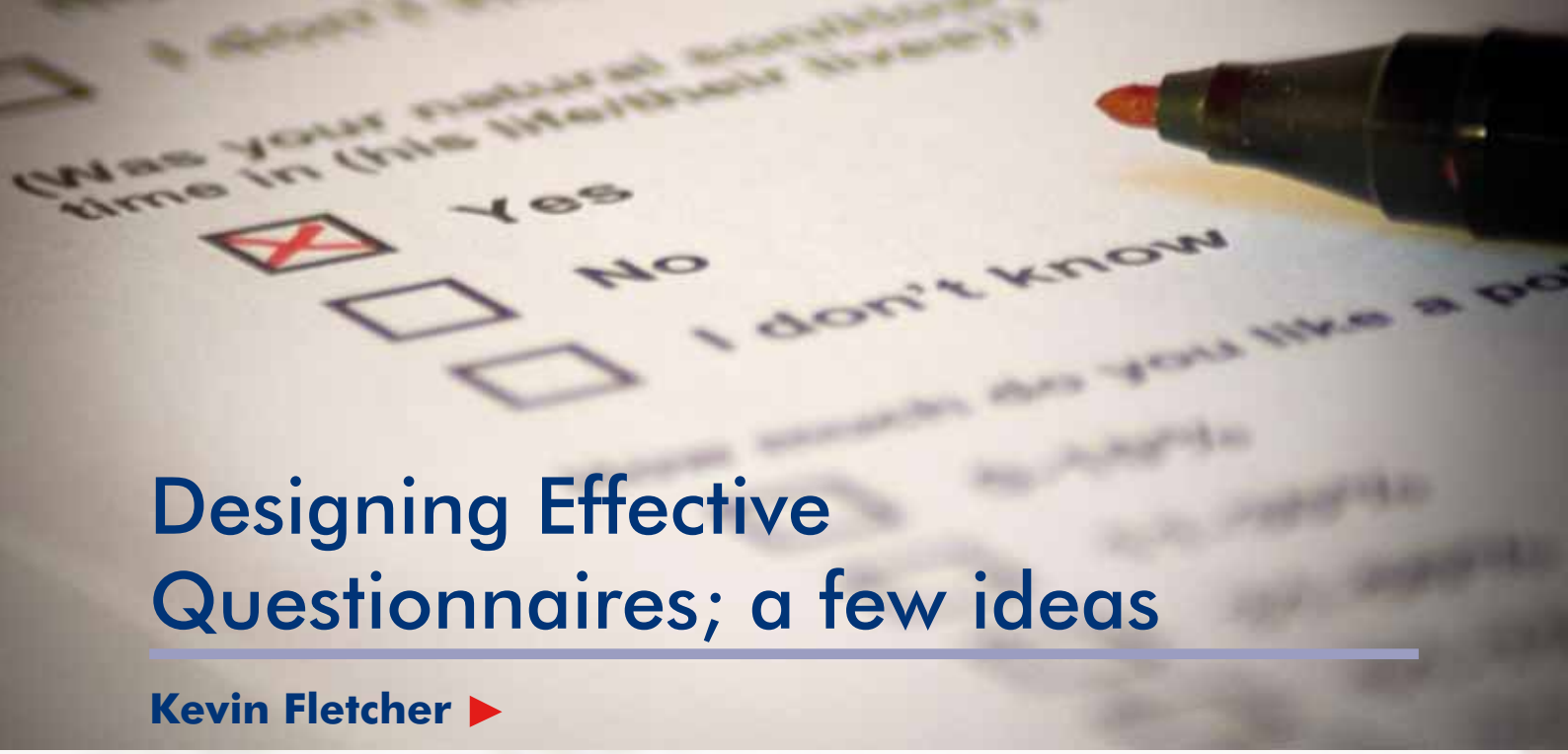

Designing Effective Questionnaires; a few ideas

Kevin Fletcher ▶

Introduction

At some point in our lives, whether it be for work, research or interest purposes, we will be asked to provide or collect data using a questionnaire.

The reason for collecting information, the way we collect it, how we intend to analyse it and use or distribute it, all affects the type of data we collect and determines the best method for collecting that data. In this short article, I intend to look at designing effective questionnaires for the purpose of collecting information. I shall not consider other information collection tools here, but instead look to provide a few pointers in designing effective questionnaires. This article might be useful, therefore, as a reference for students in Science Technology or any subject who are asked to collect information by designing and using questionnaires, or for staff who are faced with designing and using a questionnaire to gather information for a variety of purposes.

I have tried to keep this article as general as possible so that its main purposes are kept as generally applicable as possible. It focuses on questionnaires that are left with participants to complete and return later, either in-house or by post rather than oral questionnaires that require immediate verbal answers which are then written down. Its suggestions might be used in Science Technology as well as in any subject or context.

Designing and Using Effective Questionnaires

The definition of an "effective questionnaire" being used here is one that means the information we gather and collect is indeed the information that was being sought in the first place. Thus, careful design should guide planning (Bell and Raffe 1996).

What I hope to provide are a few pointers that will improve questionnaire design, and so improve the ease of completion and return of the information that was being sought, as well as the analysis of the data that is provided. The intention being that the information that comes back can then be used as was intended, hopefully with a view to improving some service or subject because of increased information available about it.

In designing questionnaires, therefore, it is important to be clear how the information provided will be analysed. If a qualitative analysis is to be used, then questions need to encourage written comments and descriptions, thoughts and feelings. If on the other hand, a quantitative analysis is intended (and this is more likely in Science Technology contexts) then completing multiple choice questions, ticking pre-worded response boxes or giving numerical ratings to certain statements might be preferred. As stated earlier; deciding how the data is going to be analysed, and later used, can help plan an effective questionnaire.

Advantages and Disadvantages of Questionnaires

Questionnaires enable a large number of participants to be surveyed and can provide both qualitative (descriptive) and quantitative (numerical) data. They are one of the most commonly used research tools and can actually help to focus the aim/ objectives/ key questions being sought (Rogers and Badham 1994). This means that in designing them, we become clearer about the information we are seeking and this many change the purpose of the exercise itself or the information we are seeking regardless of whether that is in or outside a Science Technology context.

A disadvantage of questionnaires however, maybe that pilot questionnaires may need to be used before refining the final version (Woods 1994) and this can take time. Completion of a draft questionnaire by a small sample of participants or a critical friend does take time, but the final questionnaire that emerges had been refined and can be completed in a few minutes because of design considerations in developing it. This means a well designed questionnaire can be used with large samples and once information has been returned economical data analysis can take place as problems will have already been ironed out in pilot surveys (The Open University 1994b).

Good questionnaire design should minimise participant misunderstanding of the meanings of questions, so questionnaires need to be carefully worded and in order to increase the likelihood of return, the introduction to any questionnaire should point out the intention to use it to improve a service or subject. Given that many people are motivated to want improvements, it is hoped this would assure a higher rate of return than relying on goodwill alone.

Designing Effective Questionnaires: A CHECKLIST

In designing any questionnaire, a number of factors have to be taken into consideration. These were distilled from a number of sources (The Open University 1994a, 1994b, Hardman 1994, Youngman 1994, Walford 1996). The preceding article and the checklist against which the design of any questionnaire can be reviewed which follows, came from these sources which I freely acknowledge as being part of an Open University Course I completed a while ago (E828: Educational Management in Action).

Design consideration	How the consideration was addressed
Overall appearance of the questionnaire (to encourage completion/ return)	Completion time should be stated One side of paper only Plenty of space between text Neat and tidy Clear and easy to read typeface Introductory paragraph Purpose explained Instructions in bold Logical sequencing (easy questions first) Grouping of similar short statements Tick boxes to be used where possible Thank you statement at end Stamped Addressed Envelope included (if appropriate) or clear, easy return instructions provided
Questionnaire content?	Adapt other questionnaires where possible Use open-ended question at end for other responses etc.
Language/ understanding?	Piloting/ more straightforward questions first
Response format?	Ticking boxes (all consistently ordered)
Returns?	Stamped Addressed Envelope included (if appropriate) or clear, easy return instructions provided Return Date clearly stated
Queries/help?	Provide contact address/ phone number
Testing the questionnaire?	Pilot using critical friend or small sample group
Questionnaire administration?	In-house return or postally (reminder sent out later)
Persuade responses?	Service/ Subject improvement/tailor to needs/ participants benefit
Confidentiality?	Anonymous questionnaires used
Follow up?	Coding of questionnaires (participants indicate willingness to be contacted further)
Bias?	Critical friend/ piloting/ own assumptions and reasons examined

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AUTHOR

Kevin Fletcher, BA, BSc(Hons), AdvDipEd, MA, MEd, Cert IT &Comp, FifL, EuProBiol, CBiol, MSB, MIScT, QTLS.

The Story of a Hot Little Receiver
A World War 2 Receiver Restoration Project

Keith Watt ▶

I was approached by a friend, who knew I liked and restored old radios, and asked if I would like an old receiver. He told me that he'd had a serious fire in his workshop in which many pieces of equipment were destroyed. The receiver, he said, had been in the middle of the fire and he thought it was probably only good for spare parts. The receiver turned out to be a type R209, used by the British Army from the Second World War through the 1950s. The R209 is a hermetically sealed unit (an early example of this type of construction) and appeared in three models over the period of its use; Mark 1, Mark 2 and Mark 2/B[1] – this receiver is the Mark 2 version, as may be seen in Figure 1 opposite. It is a small super-heterodyne with a frequency coverage of 1.0 to 20 MHz in 4 switches bands, capable of receiving AM, FM and CW signals.

Figure 1 – The Identity Plate.

1 Information on all models of R209 receiver can be found at www.royalsignals.org.uk

The R209 arrived sealed in a black bin liner and needless to say it had a somewhat pungent smell of fire about it. I looked at it and made a few notes:

- The headphone socket had been changed.
- There was a BNC socket in the top right rim of the front panel that shouldn't have been there.
- One of the antenna binding posts had melted in the heat of the fire.
- Most obviously it was black and not green!

Closer inspection showed that the black was actually green paint all burnt to a crisp, the only surface still green being the underside of the case, where it stood on the bench.

Figure 2 – As Received (with bin liner).

Figure 3 – Underneath – the only surface in original colour.

Figure 4 –-The Front Panel.

On opening the case, I found the insides to be in quite nice condition. The hermetical sealing had saved the insides from the smoke and heat, and there was no damage at all, although a screening cover was missing.

Figure 5 – Inside – beneath the chassis.

Figure 6 – Front Panel, stripped.

The first step was to remove the front panel in order to have it cleaned. This was quite a daunting task because the front panel actually holds all the receiver sub-assemblies together and is held in place by twenty 4BA bolts! Removal of all the burnt paint was also a challenge and would evidently be best done by gentle sand blasting.

Once the front panel was removed it became evident that the Bakelite fuse holder wasn't going to come free without causing it serious damage. It was therefore decided that rather than risk breaking the fuse holder, it would be taped up to prevent damage during sand blasting and later repainting.

Figure 6 shows the panel ready for sand blasting. The glass has been removed along with all the controls, connectors, controls and knobs. Every control had a pair of 6BA bolts holding a seal round the shaft of the control.

The front panel and case were then sandblasted to remove all the old damaged paint and get back to bare metal to allow an etch primer paint to get a good hold. The hole in the rim of the front panel where the mysterious BNC socket had been fitted was filled with a metal epoxy resin and allowed to harden, then sanded smooth to fill in the hole.

There are a number of blind holes in the panel, tapped with either 4BA or 6BA threads. In order to protect these holes, they were all fitted with bolts. Figure 7 shows the panel after sand blasting and priming, with the protective bolts still in place. The case received the same treatment, but without the complications of component stripping.

After being left to dry for 48 hours at room temperature, the first coat of Green OD[2], its original colour, was applied. After drying, another 2 coats were applied and allowed to dry before further work was carried out. All the bolts that were protecting the blind holes were removed[3] and the tape around the fuse holder was removed to reveal no damage at all to the holder. The aerial posts were refitted, but the heat-damaged one would need to be replaced as soon as possible.

Figure 7 – Sand blasted and primed.

Figure 8 –- The painted panel.

I contacted a friend in New Zealand, Brent Beven, who I knew had dismantled a similar receiver a number of years ago and had kept some of parts as spares. Lucky for me he still had a number of replacement parts needed for this project.

Brent supplied a replacement aerial post insulator and the missing screening plate from the underside of the chassis. The modified headphone sockets were removed and a set of originals fitted with a replacement surround held in place by four 4BA bolts. The headphone sockets are all rubber and when held down by the surround, they create an airtight seal (remember, this receiver is hermetically sealed).

Figure 9 — Chassis, top.

The chassis sub-assemblies were bolted back in place behind the front panel. Care had to be taken to ensure all the controls lined up centrally with the corresponding holes in the panel, otherwise they would bind and the seals would not fit back properly.

Figure 10 — Chassis – underside, showing screening plate.

The speaker door and every knob was painstakingly cleaned by hand with wire wool, then painted mat black, as they would have been originally. The dial glass was washed with warm soapy water to remove all the black soot. A rubber seal runs round the edge of the glass - this was still intact and just needed a thin film of Vaseline to allow it to make a good seal between the glass and the back of the front panel.

The speaker is mounted behind a hinged door which is closed when the receiver is not in use and the speaker is housed within an internal compartment, separated from the rest of the receiver in order to keep the inside of the receiver sealed. Next to the fuse holder is a hole where a desiccator cartridge is screwed in, along with an indicating window that shows if it needs to be replaced, the desiccant keeping the inside of the receiver dry.

Figure 11 – Chassis, rear.

The replacement for the missing screening plate, supplied by Brent Bevin, was bolted in to place on the underside of the chassis.

From left to right of the Figure 11 opposite can be seen the Local oscillator, the RF amplifier, the three I/F Amplifier cans and the Discriminator module. The large can on the right houses the 12 volt to 100 volt high voltage DC power supply.

Figure 12 – Chassis, right side.

In Figure 13 (top right), the local oscillator tuning adjustments for each of the four wave bands can be seen and some of the intricate tuning control gears can just be made out.

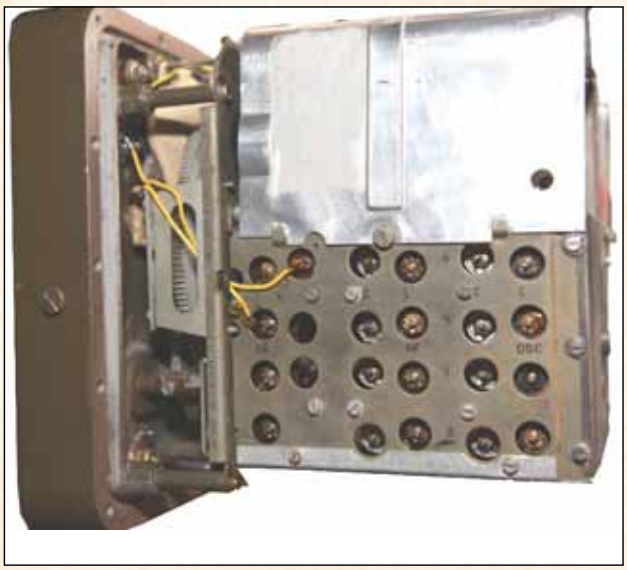


Figure 13 – Chassis, left side.

After 6 weeks of hard work the receiver is back in one piece again. All the interconnecting wiring has been either replaced or refitted. All twenty 4BA bolts have been put back in the rim of the front panel and power applied. The receiver worked first time and is now not only working perfectly, but looks as it should have done before it was involved in the workshop fire!

Figure 14 – The R209 lives again!

AUTHOR

Keith Watt is a retired Charge Nurse. He has a background in industrial electrical engineering, having been an electrical engineer for a number of years prior to his career in nursing and having worked for IBM when the first PCs came on the market. He has also been a radio amateur for some 31 years, with call sign G4MSF.

2 Green, Olive Drab.
3 All the bolts were cleaned with thinners, nothing is wasted!

From Tobacco to Test Tubes – The Gallenkamp Story

PART THREE – GALLENKAMP-TOWERS

Alan Gall, IST Archivist

J.W.Towers Ltd and A.Gallenkamp & Co Ltd were established within two years of each other, their founders seven years apart in age. As Adolf Gallenkamp expanded his London based business to become one of the major laboratory suppliers in the south east of England, the northern firm run by John Towers at Widnes also blossomed. When the two firms eventually combined, the result was an organisation with a commanding presence in most parts of the country. It therefore seems appropriate to digress a little from the main story to look at how J.W.Towers & Co Ltd developed up to the point when Gallenkamp-Towers came into being. Although Towers operated as a subsidiary for a period, it wasn't too long before the name faded way.

As far as is known, Adolf Gallenkamp had no training in science beyond the usual German school education. He regarded himself as a merchant and the production of scientific equipment followed on naturally from the days when they only supplied the products of others. John Towers, on the other hand, trained as a chemist and had a strong interest in chemical manufacturing as well as supplying apparatus. Otherwise, the two developed with the intention of offering a range as comprehensive as possible for equipping industrial, educational and research laboratories.

John Towers, shoemaker and father of John William Towers, was born in Salford about 1816. He moved to the Lancashire town of Bury where his wife Mary gave birth to John William on 6 April 1855. Worrell's directory for 1851 lists John Towers at a shoe warehouse on Market Street. The building stood in a busy part of the town's commercial area, near to the Market Hall. Now known as Kay Garden, the Market Hall site was used for the erection of a monument in 1908 to honour Bury's famous son John Kay (1704 – c1780), inventor of the Flying Shuttle.

In the early 1860s the Towers family moved to Southport, taking up residence in a detached house at 49 Talbot Street. John continued to trade in shoes but the reason for the move from Bury is unknown. Whilst living in the seaside town, John William Towers (JWT) obtained a position as apprentice to a pharmaceutical chemist and at some point studied chemistry under Professor Henry Roscoe at Owens College, Manchester. Other happenings in Southport were the births of JWT's brothers, James Garnett (1865) and Thomas Ernest (1871), and sister Elizabeth Jane (1868).

In 1872 JWT began working in the laboratory of John Hutchinson & Co. This, of course, brought him to what was already a significant centre of chemical production, namely Widnes. Conditions for the heavy chemical industry were nearly perfect there: abundant supplies of salt, limestone and coal to hand, with the excellent transport facilities offered by the port of Liverpool. But as W.J.Reader comments in his history of Imperial Chemical Industries (ICI), all was not rosy for the inhabitants:

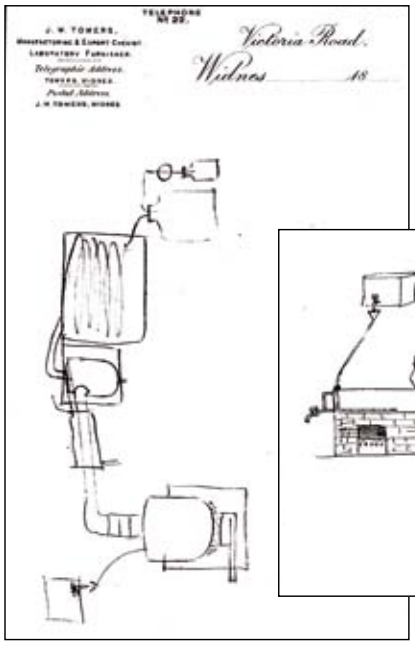
> *By the 1870s chemical works clustered thick about the disgusting town of Widnes…which was growing with the unplanned vigour and ferocity of some American mining settlement. At Widnes…fumes polluted the air, effluent the streams, and forlorn smelly hills of sulphide, acre after acre, overwhelmed the countryside.*
>
> *…as late as 1876 [referring to the Alkali Acts of 1863 which brought in some measure of public control] the Vicar of Widnes complained that the soda makers, having contributed to his endowments, seemed to think they had a right to stifle him, crumble the slates on the church roof, and drive away prospective curates.*

And J.R.Partington had this to say in his book on the alkali industry, published in 1918:

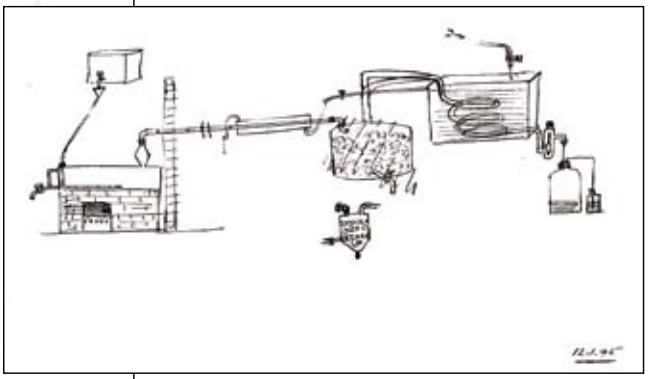
> *If we consider Widnes and Northwich … we have before us typical alkali towns. The rows of chimneys emitting black smoke from the unscientific combustion of coal, the enormous lead chambers, towers, revolving furnaces, waste heaps, with the escaping steam, the noise, and the smell of acids, chlorine, and sulphuretted hydrogen, are all familiar.*

All this did not deter young John William Towers.

Hutchinsons operated two factories for the production of alkali by the Leblanc process. By the time JWT joined the firm, John Hutchinson had died (at the early age of 40 in 1865) but the German chemist Ludwig Mond, an executor of Hutchinson's estate, was working in the



Pre-1900 Towers headed notepaper.



This sketch is from the reverse side of the pre-1900 headed notepaper. The date is 1895 and the author is probably J.W.Towers himself

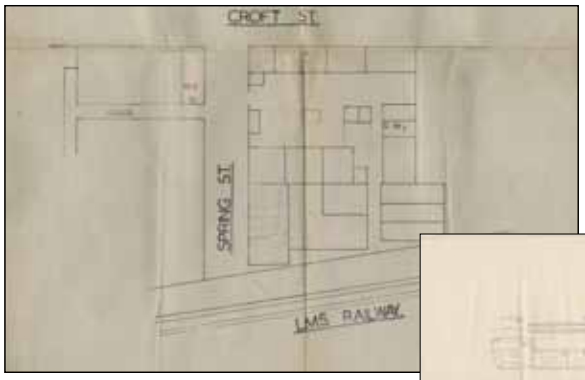
laboratory. Mond had helped develop a method for the recovery of sulphur from alkali waste in an attempt to make the Leblanc process more economical. JWT learnt from Mond the analytical tests used in monitoring the various stages of sulphur recovery. Ultimately, the Solvay soda process superseded Leblanc, and Mond made his fortune by setting up Brunner, Mond & Co (with John Brunner) to work the Solvay patents. Mond was instrumental in the formation of ICI in 1926.

After the spell at Hutchinsons, JWT moved on to become manager of the laboratory at the Atlas Chemical Company. Working hours were long but JWT found time to indulge in his hobbies of microscopy and photography. Along with Vero Charles Driffield he was a founder member of the Widnes Photographic Society. Driffield is notable for his fundamental research into photographic science, in collaboration with Ferdinand Hurter. Some of the equipment used in these experiments was supplied by JWT.

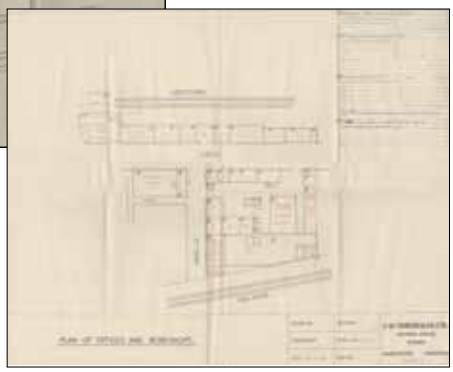
Hardie, in his History of the Chemical Industry in Widnes, says that JWT began trading on 18 August 1882, visiting chemical works to obtain orders for simple laboratory ware. It is clear that JWT also wished to produce his own chemicals and he is listed as a manufacturing chemist from early on. Hardie also says that the new business acquired two sheds on Croft Street, Widnes to store the goods (yet to be precisely located).

Croft Street, when JWT established himself there, had only recently been constructed. Named after a local landmark, Croft's House, it continued an existing road that until then had formed a T-junction with Victoria Road. JWT's post-shed premises stood on the corner of Victoria Road and Croft Street, named Victoria House. Another new road, Spring Street, branched off Croft Street and the company's works developed along its length. One advantage of the location was the closeness of Widnes Station, at the bottom of Spring Street. In the days before well-developed road transport systems the railways were an important means of delivering goods. Another rail link ran immediately north of Croft Street - the Sheffield and Midland Joint Railway. The London and North Western Railway served Widnes Station.

Surrounding Croft Street were the customers: the multitude of chemical and metal works



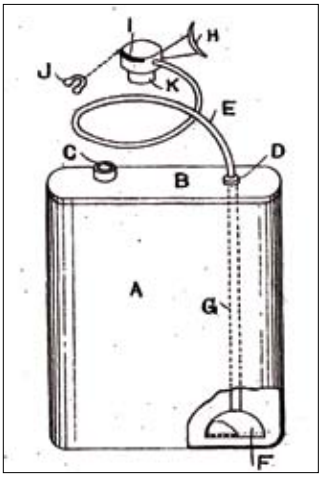
Works layout in 1939 (courtesy of the Catalyst Science Discovery Centre, Widnes)



Works layout in 1958 (courtesy of the Catalyst Science Discovery Centre, Widnes)

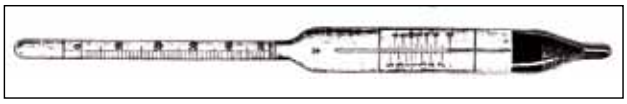
JWT's sister Elizabeth Jane had married (in 1891) Hugh Swainson Barker, a shipping agent born in Thetford and the son of a tax inspector from Lancaster who brought the family up to Liverpool after a long period working (and fathering) in Norfolk and Cambridgeshire. Hugh joined JWT and by 1905, when J.W.Towers & Co Ltd was incorporated, had become a junior partner in the business. This was reflected in the salaries for that year. As sub-manager, Hugh earned £200 per year, compared to JWT's £400. Presumably, his experience as a shipping agent helped with the imports of equipment and export sales. Hugh died in 1923 and Mary Elizabeth Towers took up his place on the board of directors. Hugh Barker's middle name of Swainson continued in the family following the birth of JWT's son John Swainson Towers in 1904.

JWT patented a respirator in 1896, said to be a forerunner of the familiar gas mask used in World War One. He also invented an alternative means for controlling the discharge from burettes (another existing device being Mohr's spring clip) in 1918. In collaboration with the United Alkali Company a means of sealing ampoules, whilst minimising the effect that a heated glass neck might have on the contents, was developed and the subject of a patent in 1924.



The 'Towers Respirator' of 1896.

Over half a century before JWT had started trading in Widnes, the name of Mottershead was associated with a chemists shop in Manchester. In the 1820s it operated under Mottershead & Brown, in the 1840s and '50s as Mottershead & Roberts and, finally, as Mottershead & Co. By the mid-nineteenth century photographic apparatus had been added to the dispensing of drugs and in the early 1880s they were advertising themselves as 'Pharmaceutical chemists, dealers in chemical and philosophical apparatus, and electric bell and speaking tube fitters.' The shop premises stood at 10 Half Moon Street with works on Mary Street, Strangeways, both in Manchester.

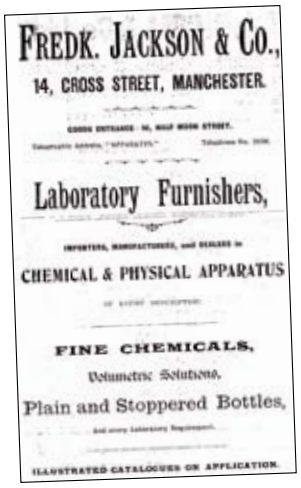


An interesting hydrometer calibrated to read percentage glue directly, with a built-in thermometer for corrections (priced at 27 shillings in Towers catalogue No 53)

A change came in 1890 when Frederick Jackson became the successor to the Mottershead business. Jackson had started as an apprentice to a chemist (possibly Motterheads) in his teens. The base of operations remained in Manchester until just before the First World War when Frederick Jackson moved to a building at 44 Chapel Street, Salford. By then, the concentration on laboratory furnishing had been firmly established. Fredk Jackson & Co Ltd, as it became, was acquired by Towers in about 1940. This added another branch to the one already established in Liverpool.

Fredk Jackson continued to exist as a company and was not dissolved until much later.

The Liverpool branch was no doubt selected for its proximity to the University of Liverpool. Its position at 134 Brownlow Hill also put it nearly next door to the workhouse. When Towers moved into number 134, certainly before 1922 and probably just after WWI, the workhouse would still have been functioning.



Advertisement from 1906

It was originally erected around 1771 and considerably enlarged over the years. The workhouse buildings were demolished in 1931 to make way for the Roman Catholic Cathedral. Today, one of John Moores University's departments straddles the site of 134 Brownlow Hill.

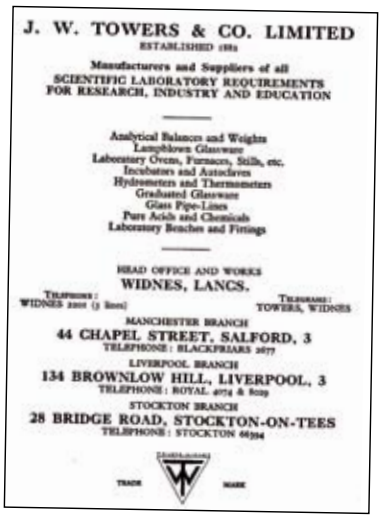
Not all manufacturing was based at the Croft Street site. A large house set in spacious grounds formed the nucleus of a separate works on Ditchfield Road, Hough Green, Widnes. This housed the volumetric-glassware graduation department and balance production. Sports facilities for the staff were provided at the rear. Known as Brookfield Works, it provided an eventual 27,000 feet of floor area. The buildings were pulled down in recent times and a wooded area between Brackenwood Drive and Rosewood Grove marks the location.

Glassblowing workshop on Sprint Street (Towers catalogue No 53)

Machine shop producing fine balance parts (Towers catalogue No 53)

JWT and his wife Mary Elizabeth had two daughters, and a son John Swainson Towers. John junior became a director of the company in 1925, assuming full control when his father died in 1941. JWT did not live to see the marriage of his son on 19 September 1942 to Beatrice (Betty) Whinnerah, a member of the Women's Auxiliary Air Force. Betty also joined the board of directors.

Another branch of Towers, and the last as it turned out to be, was established in 1947 under Jack Oldfield as manager at 28 Bridge Street, in Stockton and at another building just up the road, 1 Wood Street. The attraction of a Teeside location was the large number of chemical plants and steelworks in the area. John Pinder (Jack) Oldfield had joined Towers in 1946 from the RAF and would become Managing Director of A.Gallenkamp & Co (Northern) Ltd. He resigned in 1978, 32 years after joining Towers.



Entry in the 1951 Handbook of the Scientific Instrument Manufacturers Association

Eric Borradaile-Jones joined J.W.Towers on leaving the Royal Air Force in 1947, working under Richard Allan at the Liverpool branch. He recalls that the company training scheme was very thorough, with time spent learning the 'ins and outs' of each department at Widnes. On returning to Liverpool, Eric worked as a representative for the sales area covering north Wales, Merseyside and part of Lancashire. J.S.Towers was keen on expanding into London, Gallenkamp's turf, which he did by opening a branch at Uxbridge in 1953. Eric became assistant manager with responsibility for field sales in London and the southern counties.

According to some accounts, as the 1950s drew to a close John S.Towers, although not yet sixty, became concerned that the high level of death duties on his demise might result in the collapse of the company. He worried about the loss of both jobs and the business that his father had built up over so many years. Another view is that Towers badly needed to modernise if it was to survive against the competition and John came to the conclusion that selling-out was the easiest option. Whatever the reason, a marriage with Gallenkamp suited both partners.

Students who wanted equipment and chemicals for home experiments could call at Frederick Jackson's premises in Salford with a list of their requirements. Fourteen- year-old Alan Mason became a customer, little expecting that fifteen years later he would be based in the same building, working as a rep for J.W.Towers. Starting as a pharmacist's apprentice in a shop on Upper Chorlton Road, Manchester, and after a number of jobs (mainly) at dye works, he joined the Bleacher's Association. This had been formed in 1900 to amalgamate a large number of bleach works and processors of cotton goods. After a period working in the laboratory at the Association's Manchester HQ, Blackfriars House, Alan was promoted to the post of works chemist at one of the component firms – Sykes Bleaching Company, Edgeley, near Stockport. It was there that he met Derek Flint, a representative for J.W.Towers, who turned up one day with the information that his boss was

Taken in 1962. Left to right: Alec Rundle, Chairman of A.Gallenkamp & Co (Northern) Ltd, Jack Oldfield, Managing Director of A.Gallenkamp & Co (Northern) Ltd, Stanley Davies, Chairman of A.Gallenkamp & Co Ltd

looking to increase the sales force. Alan duly wrote to Towers and was interviewed by a Mr Knowles at Salford, followed by an audience with John S.Towers at Widnes. Mr Knowles even visited Alan's home to assess his suitability! One drawback was that Alan had not passed his driving test and so trips to visit industrial and educational premises were made by bus. Eventually he acquired a Ford Anglia and Mr Knowles, who lived on the route to Salford, often availed himself of a lift into work. Previously, Alan had moved to a new job every few years but now he found the work so interesting that he stayed until his retirement.

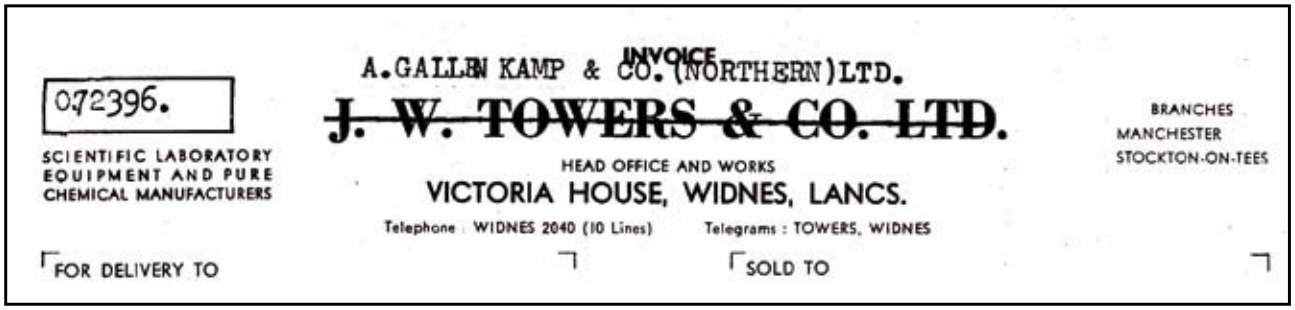
On the 3rd November 1959 A.Gallenkamp & Co Ltd acquired the whole of the issued share capital of Towers. The Brookfield works joined Gallenkamp's group of glassware factories, already situated at Lower Sydenham and Saxmundham. However, the Stockton-on Tees branch fell short of requirements (as a town centre site it had limited potential for expansion) and was closed. A new building to replace it, on Portrack Industrial Estate, Stockton, officially opened on 3rd July 1962. Uxbridge branch became a centre for the repair and servicing of equipment made by both companies, as part of the instrument department based at the Chalfont St Peter works.

Towers continued under its own name as a subsidiary of Gallenkamp until the beginning of 1962. In February of that year came the announcement that J.W.Towers & Co Ltd would trade under the name of A.Gallenkamp & Co (Northern) Ltd. Either because of frugality or the lack of proper stationery, the Widnes offices continued using Towers' existing notepaper and forms, but with the new name typed in over the old.

For previous instalments of the Gallenkamp history see:

Part one – the years up to the Great War, The Journal, Winter 2008

Part two – the years up to the end of the Second World War, The Journal, Summer 2009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'Waste not, want not' Towers invoice from 7th June 1962 with Gallenkamp typed in

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Census returns.

Acknowledgements

Thanks to:

John Barlow, ex-employee of Gallenkamp.

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Alan Mason, ex-employee of Gallenkamp.

Paul Meara of the Catalyst Science Discovery Centre, Widnes.

Joan Taylor, Widnes Library.

Ken Pyke, ex-employee of Gallenkamp.

Servicing and Maintaining Routine Optical Microscopes

This is just one of over 250 different skills development events which are now available on the HEaTED website. This course tackles the basics of microscope servicing and maintenance. It includes an introduction to fundamental microscope design, how to use the microscope correctly, how to maintain microscopes and some tricks of the trade. It is mainly aimed at technicians using microscopes especially in schools and teaching labs in universities, however others working with microscopes would find it equally useful.

On 13th January 2010 Derek Sayers and his wife ran the second HEaTED course on "Servicing and Maintaining Routine Optical Microscope" at Bradford University.

"To say the weather was rather inclement on that day was an understatement. There was thick snow and ice covering the whole Country and it seemed to be especially bad in Bradford. Only eight of the original twelve delegates managed to brave the weather.

Kathy Illingworth, the excellent organiser at Bradford, had to change our original venue at the last minute because that laboratory was "too cold", and then to add to it all the University was closing early because of the extreme weather and the course had to be shortened.

Running a Course on maintaining a microscope can be difficult because there are so many different types of light microscope available. The newer ones for university student use are designed to be tamper-proof and require very little maintenance. However, as a microscope ages and it has been used by many heavy handed students problems will arise.

I started the course by giving a short talk on the history of the microscope, before describing the various parts. I then explained in more detail how to dismantle, clean and lubricate the microscope, and then set up the illumination etc. I stressed that the biggest problem is lack of lubrication, especially on older microscopes. It is practically impossible over-lubricate a microscope. I gave a small booklet on "Tricks of the Trade" to each delegate.

Most people are initially frightened to dismantle a microscope for fear of 'doing something wrong'. This course has been designed to overcome those fears. However, in just a few short hours it is obviously not possible to explain every aspect of light microscopy; you can only tackle the major fundamental points. Although I could not cover every eventuality on the day I was happy for delegates to contact me by telephone or email and I will always try to assist with solving their microscope problems."

Michelle Jackson, HEaTED Technical Skills Manager, put some questions to Derek following the course.

Michelle Jackson:

What do people get out of the course?

Derek Sayers:

Well, most of the delegates I spoke to seem to be working in teaching labs where they are confronted with minor problems on microscopes, where many of these could be corrected by routine servicing. The course hopefully showed them how to carry out a good service and overcome and prevent the usual simple problems. Nothing is more annoying than having a minor fault, not knowing how to put it right and having to call in a very expensive service engineer.

Michelle Jackson:

What did they enjoy most?

Derek Sayers:

I presume it was pulling a microscope apart and knowing that at the end of the Course it would be working again. Some delegates became so confident that they stripped down a big microscope that had not worked for years, and although they did not finish it by the end of the course they felt they had the confidence and new skills to complete the rebuild (they have not contacted me since so I feel sure they were successful!)

Michelle Jackson:

Why are you so well placed to run the Course?

Derek Sayers:

I have my own company Reco Laboratory Services and we have been servicing, repairing, and selling microscopes and other laboratory equipment since 1975.

During that time we must have serviced/repaired thousands of microscopes, in the main from teaching laboratories. Some of the microscopes we have worked on date right back to the early part of the 19th Century (and we still carry spares for some of these microscopes!). Since we started the company we must have come across practically every type of microscope problem possible.

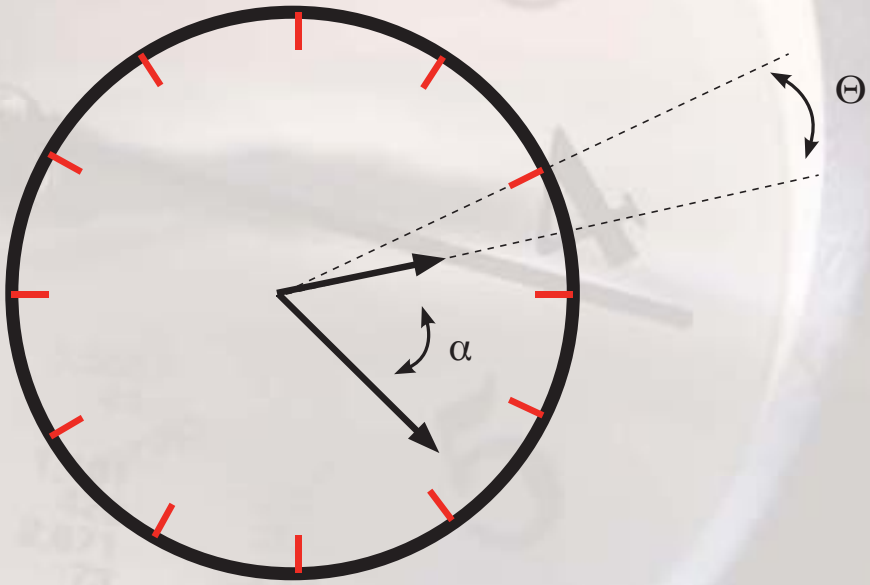
Puzzle Corner

Alan Gall, IST Archivist

Dave Kennils is winner of a £10 book token for his solution to question 1 of 'There's a fly in my soup' in the last issue. His sequence is Soup-Sop-Fop-Foy-Fly.

As no correct solutions to the other problems have been received so far, the deadline is extended to the copy date of the next issue. One or more book tokens could be yours with just a little mental effort.

To replenish the stock of conundrums here is the Hungarian Clock Problem.



Lajos Kaczynsk is a wildly eccentric Hungarian mathematician. He owns a clock that has hour markings but no numerals and as the clock is perfectly round and sits in a random position on his bedside table there is no way of telling which mark indicates 12 o'clock.

Lajos wakes up one morning thinking that he has probably overslept. With a protractor, handily kept under his pillow, he measures two angles. One angle is between the hour hand and the nearest hour marker to be found in the anticlockwise direction (theta), the other (alpha) is between the two hands as measured clockwise, starting with the minute hand. A quick sum in his head gives the time. How does he do it?

The answer does not need to be perfectly correct. The best attempt will be rewarded with a £10 book token.

Solutions to alangall@hotmail.com or the IST office. Please include your name and membership number.

From the Archives

Alan Gall ▶

The London firm of S.W.Partridge & Co published *The Welcome: A magazine for the Home Circle* from 1876 to 1888. A *Readers Digest* of the day, it packed in popular science, fictional stories, travelogues, biographies, health advice, natural history and reports taken from numerous newspapers and other periodicals. These are some of the morsels fed to Victorian readers in 1887. Page numbers are from the year's bound volume.

Some Recent Progress in Astronomy (pages 371 - 374)

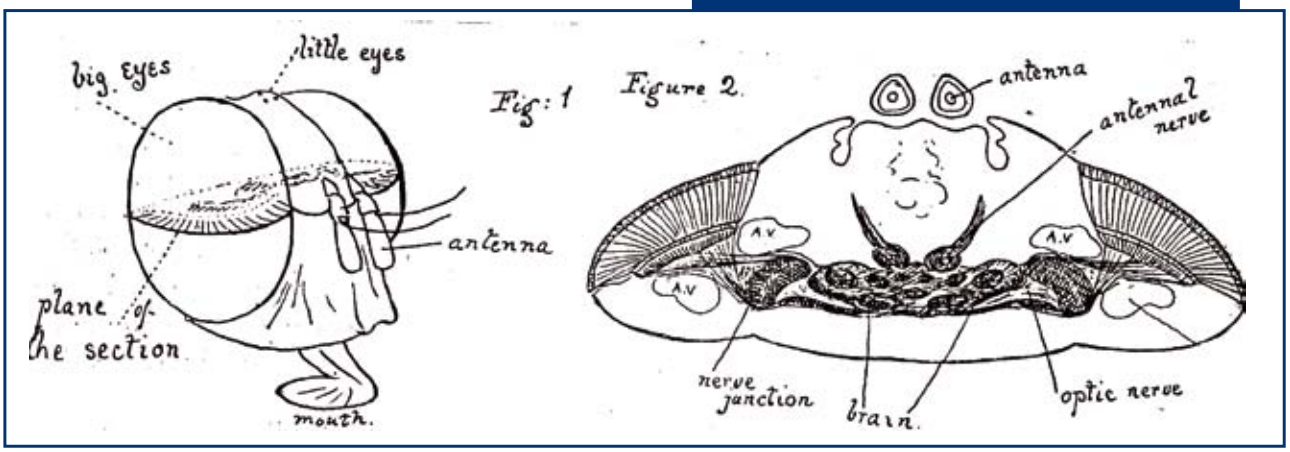
[Regarding the planet Mars] It is now in fact very generally accepted among astronomers as in some respects another earth. It appears to have land and water, an atmosphere, clouds, and snow. From the small amount of the latter that seem to accumulate at the poles of the planet, it would appear to have a mild climate. A most remarkable thing is, however, that the water seems to be distributed in a series of long parallel streams or canals as well as in ocean-basins, from which the canals run out in some places to a distance of from three to four thousand miles.

[Regarding the sun] It is not given to mortal beings to investigate these marvels closely and live, but a considerable amount of scientific labour has been undertaken to arrive at some idea of the sun's heat, and Professor Langley has estimated that it is from 1,800 to 2,000 degrees Centigrade, i.e., two thousand times as hot as boiling water. He arrives at this idea by his volometer or radiant-heat-measurer, an electrical instrument in which calorific – i.e., heat-vibrations, are changed into electric currents.

Exploring the Earth's Interior (page 319)

Exploring the interior of the earth on a gigantic scale seems, says the Graphic, to be the great idea just now of scientific men on both sides of the Atlantic. The well-known Parisian scientist, M. Camille Flammarion, suggests that a hole several thousands of yards deep should be excavated in the earth in order to furnish accurate knowledge as to the composition of the interior of the globe. Let the European Governments, he proposes, lend all their troops to carry out this colossal work, and by so doing two grand ends would be gained, the mystery under our feet would be revealed while soldiers would forget how to fight.

Outline of a fly's head and section through the brain, from 'A Fly's Eye' by H.M.J.Underhill (pages 528 – 532)



Remedies for Rheumatism (page 639)

President Cleveland has been suffering with rheumatism, so his sympathising countrymen have sent him thirty-nine remedies for the malady. His secretary publishes the list with thanks to the senders. Amongst certain other cures the President was recommended to apply hot flat-irons to keep his muscles lissom by sabre exercise, to live upon oatmeal and gruel, or raw beef, German bread and dry Rhine wine, to use goose-grease, a fly blister or liniment of rattlesnake and skunk oil, and to carry horse chestnuts in his pocket.

Ancient Popular Remedies (page 639)

A dead man's hand could dispel tumours of the glands, by stroking the parts nine times; but the hand of a man who has been cut down from a gallows-tree was, we need not say, a remedy infinitely more efficacious. The chips of a gallows on which several persons had been hanged, when worn in a bag around the neck, was pronounced an infallible cure for the ague.

Twenty-six Christian Names (page 127)

A Buckingham farmer lately presented his firstborn for christening at his parish church with twenty-six Christian names from the Scripture, and representing every letter of the alphabet. The names commenced with Abel and ended with Zachariah. It was only with the greatest difficulty that the clergyman persuaded the farmer to content himself with the first and last of the appellations proposed. The surname of the unfortunate infant is Jenkins.

Sugar as an Article of Diet (page 192)

Dr. Phipson advocates, in a German scientific journal, the general use of sugar as a regular article of diet. For forty years he has eaten at least a quarter of a pound daily, not counting the sugar-forming substances taken at the same time, and has found it very healthful. Men's condition would be greatly improved if the use of sugar should substitute that of alcohol.

Engraving of Sir Humphry Davy, from a biography of the famous scientist by C.Nisbet (pages 329 – 333)

An Eccentric Executioner (page 448)

A well-known executioner has recently died, the Cologne headsman. He was the only executioner in Germany to who used the guillotine, all others preferring the old-fashioned axe and block. This worthy functionary was one of the characters of the city, and in the course of a long life had been successively dog-catcher, reporter, doctor, veterinary surgeon, detective, and finally headsman. For twenty years he had kept his coffin in his bedroom, containing the full-dress black suit in which he wished to be buried – a wish duly fulfilled.

Sunstroke and Inebriety (page 192)

There is a peculiar smell about a sunstroke man that seldom deceives, but sometimes it is difficult to be certain whether he was more than drunk. When I was in the city hospital [New York] I had, during the summer of 1878, thirty or forty cases every day, and the never-failing test was to dip the patient in an ice-cold bath. If he was sunstruck, he would show signs of relief, and be quiet, but if he was drunk, he would sober up in an instant, and quote Scripture and recite poetry with an emphasis which was astounding.

Connection between Drunkenness and Idiocy (page 384)

Dr. Down's opinion that acute alcoholism produced a distinct form of idiocy has, says the Alliance News, been questioned; but M.Morel, of Rouen, had noticed similar facts, and Dr. Ruez had observed that idiocy was very common among the miners at Westphalia, who, living apart from their wives, only came home, and generally got drunk, on their holidays.

Sir Charles Wheatstone, pictured in an article on the electric telegraph by J. Bowles Daly (pages 686 – 692)

Preference for Green Printing-paper (page 638)

Several of the French railway companies and other public bodies have resolved on having their printing done on green instead of white paper. The reason for the alteration is that they believe the combination of white paper with black characters endangers the eyesight of their work people.

German versus English Clerks (page 63)

It may be taken for granted that there are very few English merchants who are unpatriotic enough to prefer – caeteris paribus – the Teuton to his British cousin. But unfortunately the other things are not equal. The German comes over to England equipped with a good knowledge of French and a sufficient knowledge of English, which he soon improves. He is also provided with a fair share of brains, a certain amount commercial education, and, lastly, an inexhaustible capacity for work.

Mr. Ruskin on Cycling (page 44)

Mr. Ruskin says he not only objects, but is quite prepared to spend all his best "bad language" in reprobation of bi- tri and 4- 5- 6- or 7-cycles, and every other contrivance and invention for superseding human feet on God's ground. To walk, to run, to leap, and to dance are the virtues of the human body, and neither to stride on stilts, wriggle on wheels, or dangle on ropes; and nothing in training of the human mind with the body will ever supersede the appointed God's way of slow walking and hard working.

Common Causes of Baldness (page 639)

Lecturing before the Hairdressers' Guild recently on "The Common Causes of Baldness" Dr. Startin said that ordinary baldness in men and women, apart from the natural falling off of the hair in old age, was due to fever, gout, much study, violent emotion, indigestion, want of proper attention in dressing, cutting, and washing, tight hats, extreme heat or cold, tight plaiting, and the wearing of heavy pads or head-dresses.

Animated MS Sermons (page 763)

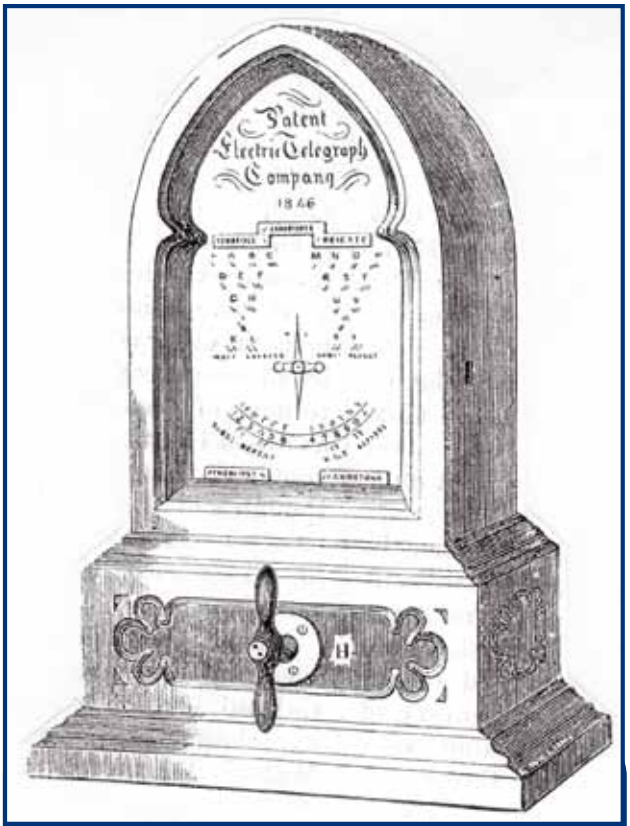
A lot of unclaimed freight was recently sold at Liverpool. Amongst the goods there turned out to be two hundred manuscript sermons written by a clergyman. The purchaser discovered curious notes on the margins, such as the following:

"Deliver this passage in solemn tone," "Scornful smile after the word 'never,'" "Close Bible with violent slam after this passage," "Contemplate the ceiling in attitude of adoration at this point," "Sarcastic wave of hand," "Rapid gesture."

The Antiquity of Football (page 192)

At the Court Leet held on October 12th, 1608, the following resolution was passed:

"That whereas there hath bene heretofore great disorder in our toune of Manchestr, and the inhaitants thereof greatelye wronged and charged with makings and the amendinge of their glasse windows broken yearelye and spoyled by a company of lewd and



The Cooke & Wheatstone Single Needle Telegraph (from J.B.Daly)

disordered p'sons vsinge that unlawfull exercise of playinge with the ffoteball in ye streets of the said toune, breaking many men's windowes and glasse at their pleasures, and other greate inormyties. Therefore wee of this jurye doe order that no maner of p'sons hereafter shall playe or vse the footeball in any street within the said toune of Manchester… [NB some inconsistencies in spelling]

Donkey Parties (page 255)

Donkey parties are, according to the *Graphic*, the latest rational amusement of provincial gatherings across the Atlantic. A huge donkey, minus its tail, is cut out of calico, fixed against the wall, and all the company are provided with pins and calico donkeys' tails. Each guest is then blindfolded in turn, placed opposite the figure on the wall, twisted round three times, and left to pin the tail in its right place on the donkey. As the blind man scarcely ever hits the right place, the company get plenty of fun out of their game.

Another Cure for Consumption (page 320)

Dr. M'Claughlin, head physician of the Philadelphia Hospital, reports the marvellous and unprecedented cure of thirty patients in the last stage of consumption, solely by means of rectal injections of carbonic-acid gas. The gas is prepared according to the system outlined in a recent paper by a professor of the Lyons University. The medical authorities at the hospital express the belief that an absolute cure for consumption has been found.

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What is the IST?

The Science Technologists Association was formed in 1948 and granted a certificate of incorporation in 1954 to become the Institute of Science Technology (IST). Its past traditions lay in the promotion and development of the science and practice of laboratory science technology. A further name change was agreed in 2007 to the Institute of Science & Technology in order to broaden our focus area.

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

The IST itself has continued to move forward and expand its own horizons so that it can best position itself to support its members and their needs in the 21st century.

Who is it for?

We now reach out to provide individual and focused professional support to a wide group of specialist, technical, and managerial colleagues in a broad range of environments such as science, engineering, industry, local authorities, schools, FE, HE, research/analytical/health facilities, government departments, and many more in the UK and overseas.

Our aim is to make the Institute all embracing and, in order to achieve this, help/advice networks, skills training, specialist forums, recognised qualifications, continuing career development opportunities and guidance will be available to the membership.

Recognition of professional standing is high on our agenda and, most importantly, expansion of the vibrant community of specialist, technical and managerial colleagues who will work together to help make a difference and shape the future.

Why join?

IST can help by supporting and developing your

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

Help us maintain, build and expand the (IST) community. **Together we can be a voice to be heard and listened to.**

To join or learn more about the IST go to
Web: www.istonline.org.uk or Email us at: office@istonline.org.uk

IST New Members

October 2009 – June 2010

NEW MEMBERS LIST

Membership No	Members Name	Grade
T14693	Mr A A Adedokun	MIScT
T14694	Mr R C Hayward	MIScT
T14695	Mr P Mason	MIScT
T14696	Mr D L Parton-Ginno	MIScT
T14697	Mr P Hopkins	AssocIScT
T14698	Mr B G Palmer	MIScT
T14699	Mr H Amafu-Deh	AssocIScT
T14700	Miss E Amedorme	AssocIScT
T14701	Mr M P Cosgrove	FIScT
T14702	Mr J D Woolsey	MIScT
T14703	Mrs S L Waite	MIScT
T14704	Mr G A Talabi	MIScT
12 IN TOTAL		

HIGHER DIPLOMA

Membership No	Members Name	Grade
T14204	Grace Adoley Dartey	Pass
T14681	Emmanual Adu-Ofori	Pass
2 IN TOTAL		

Article submissions for the IST JOURNAL

We welcome article submissions covering all areas of science and technology, including article submissions which cover new technological advances, diverse technology and unusual aspects of technology. We particularly encourage submissions from people who may wish to publish for the first time, and can offer help and assistance in putting a first article together.

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 31st May.
   - 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

IST New Members

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

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

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

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

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

PERSONAL DETAILS

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

Surname: .....

Other Names: .....

Date of Birth: .....

Home Email address: .....

.....

Telephone: .....

Address for correspondence: .....

.....

.....

.....

A. DETAILS OF PRESENT POST

Job Title: .....

Date of Appointment: .....

Employer Name: .....

Employer Address: .....

.....

Email: .....

Type of work or discipline: .....

.....

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

.....

.....

.....

B. PREVIOUS EMPLOYMENT HISTORY

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

C. QUALIFICATIONS

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

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

D. COURSES & OTHER RELEVANT DETAILS

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

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

Continued overleaf

E. REFEREE

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

Name: .....

Position: .....

Organisation: .....

Qualification(s): .....

Email: .....

Address: .....

.....

.....

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

Email: **office@istonline.org.uk**

FOR OFFICE USE ONLY

Application received: .....

Registration fee received: .....

Referee form sent: .....

Applicant notified: .....

Grade awarded: .....

Membership fee received: .....

Membership No: .....

Membership card & Diploma sent: .....

Direct debit instruction received: .....

IST Registered Practitioners

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

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

Criteria for Registration include:

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

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

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

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

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

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

iii) they cease to be a technical practitioner.

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

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

www.istonline.org.uk

Reverse of cover page.

The Institute of Science & Technology

The Journal

Summer 2010

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