Institute of Science Technology

The Journal

Summer 2006

The Official Journal of The Institute of Science Technology -
The Professional Body for Specialist, Technical and Managerial Staff

Reverse of cover page.

The **Journal**

The Official Publication of the Institute of Science Technology

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Summer 2006




Editorial

Ian Gray

I hope you all received your interim newsletter in the Spring. If not you need to contact the Office.

I was delighted to be able to say a few words at the Manchester meeting in May about Dave Moore, recently deceased, who was one of our stalwart members on Council over many years. I have précised the following account for your interest and hope it encourages you to attend any of the future events the IST arranged as they can often be exciting.

The series of meetings held in Manchester around the 10th May were very exciting indeed. The Technicians in Education Group organised a "Your health, safety and professional development" seminar, which was not only well attended but extremely "educational". Dr Melanie Taylor introduced us to how risky situations could develop into major problems and helped us assess the level of risk which might be "tolerated". The COSHH Essentials were then developed by Philippa Nobbs, of Safety and Technical services, and she demonstrated the 4 control approaches needed including 1-General ventilation, 2-Engineering control (single point through to a ventilated partial closure), 3-Containment, which greatly reduces exposure and 4-Special where expert advice is to be sought. Various personal protective equipments (PPE) were then explored with Jean Davies of Scientific and Chemical Supplies Ltd. Philippa then put on another hat to outline Occupational Health Issues and how to deal with staff at risk before Cath Davidge of University of Manchester gave us a very sobering account of health and safety on field courses.

The afternoon began with the 'Dave Moore Memorial Lecture' presented by Dr Sarah Heath and this was where the afternoon nearly took off literally! Coming from the School of Chemistry Sarah was armed with a stunning array of various chemicals to delight the eye and the ear with! The title was 'Health and Safety for Wimps!' and was not for the faint hearted, who were given advance warning. Usually the first presentation after a nutritious and expansive lunch can be a rather subdued affair, which is unfortunate for the presenter, but this was very different. Sarah energetically demonstrated how safely you can make chemistry exciting by pouring some water into a large round and stoppered clear vessel, which contained some ether covering a small potassium pellet. Once the water met the potassium the heat generated ignited the ether and we wondered at the floating glow of burning ether contained within. Hydrogen was then generated and a plastic bottle filled with the gas before it was 'fired' across the room. She demonstrated how to show students the generation of colourless gases but pouring some hydrogen peroxide into a measuring cylinder together with a small amount of detergent before adding some potassium iodide. The resultant reaction caused a huge volume of detergenty foam to escape and completely encase the cylinder, and half the bench! Numerous other 'exciting' reactions followed before she bowed off from an appreciative audience.

There was a solid reason for this spectacular lecture in that directly afterwards the audience were then invited to carry out risk assessments on the whole presentation (although this had obviously been done beforehand as several of the experiments were 'toned down' because of the room size!). Issues such as 'Preparation' included handling liquefied gases (nitrogen), electric shock of lecturer, handling glassware together with 'Transport' where issues of manual handling, asphyxiation and fire were prominent. The 'Venue' was a critical risk element as where the 'Audience' who might have been vulnerable to smoke, bright lights and bangs! The 'Presentation' was assessed for the likelihood of burns, smoke inhalation, slips etc to all concerned and also the 'Clear-up' was the final element to have a risk assessment. Quite a daunting array of paperwork was necessary for this 30 minute presentation.

Several IST presenters then discussed qualifications, awards and professional development for laboratory staff before the close.

The IST AGM followed with reports from the President, Chair and Treasurer.

I would strongly encourage you to be as active as you are able in the coming months as the Executive has embarked on an ambitious development programme and your support at these meetings is really helpful as a guide for them. There is a strong interest in Chartered Scientist status but the IST stills invites your comments over potentially new avenues for it to pursue.

Captions for the images supporting the article 'Alexander Scott and the Hafnium Affair'

Page 4, left: *An advertisement for the sale of hafnium which appeared in 'Nature', June 1924. The suggestion is that hafnium is a Rare Earth, which was not shown to be the case a few years earlier.*

Page 4, right: *Alexander Scott (1853 - 1947)*

Page 5, *Photo of Sir James Dewar holding a flask, taken by Alexander Scott in 1902.*

Letter to the Editor

Dear Sir,

Dr Sidney Osborn

I was fascinated to read the article contributed to "Science Technology" by Dr Sidney Osborn.

Dr (then plain Mr) Osborn gave me first job as a physics technician at UCH and it was through the support given by him and the hospital that I was able to undertake the City and Guilds courses which eventually led to my membership of the Institute.

During my time at UCH, as well as transporting radium needles to and from operating theatres, a part of my time was spent assisting with the Medical Research Council project that Dr Osborn used to get his PhD. As a sideline, I also helped him with the compilation of his thesis – 6 copies of a very impressive weighty tome involving a huge number of photostats (electrostatic photocopying was yet to be commercially available!). I was greatly pleased to be mentioned in his report along with junior physicist Bridget Carter for "many thousands of film badge measurements". I can still picture the darkroom in which I developed them, and the densitometer used to take readings, to this day!

An incident that Dr Osborn did not mention in his lecture was the day a Cobalt-60 "bomb" stuck in the treatment head of the radiotherapy machine at UCH. Nearly the entire Physics Department rushed to the scene. I remember Dr Osborn saying to me that nurses were not allowed to run on duty whatever the situation, but we were not nurses, so we arrived at the Radiotherapy Department quite out of breath. Sidney Osborn took charge and within minutes a plan was developed for releasing the Co60 source and returning it via the flexible tube to it's lead-lined "safe". This involved sending technicians into the treament room on a rota to minimise the radiation dose each received.

I have always been grateful to Sidney and his team at UCH for the start they gave to my career. I never did get the recommended Maths 'O'-level, but nonetheless have spent most of the rest of my career working with computer systems.

Note to editor: I would appreciate it if a copy of my letter could be passed onto Dr Osborn.

Yours Faithfully

Peter Mannell MIScT

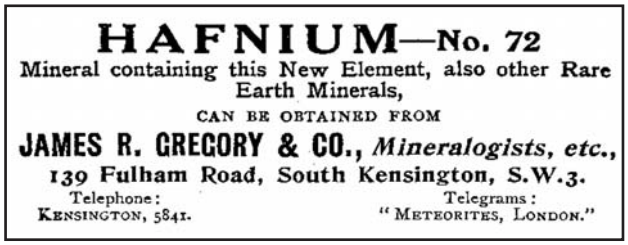
HARPENDEN, UK

Alexander Scott & the Hafnium Affair

Alan Gall, IST Archivist

A bright metallic element found in zirconium ores: used in tungsten filaments and as a neutron absorber in nuclear reactions. Symbol: Hf; atomic number: 72; atomic weight: 178.49; valency: 4; relative density: 13.31; melting point: 2150; boiling point 5400. Named after Hafnia, the Latin for Copenhagen

(Dictionary definition for hafnium)

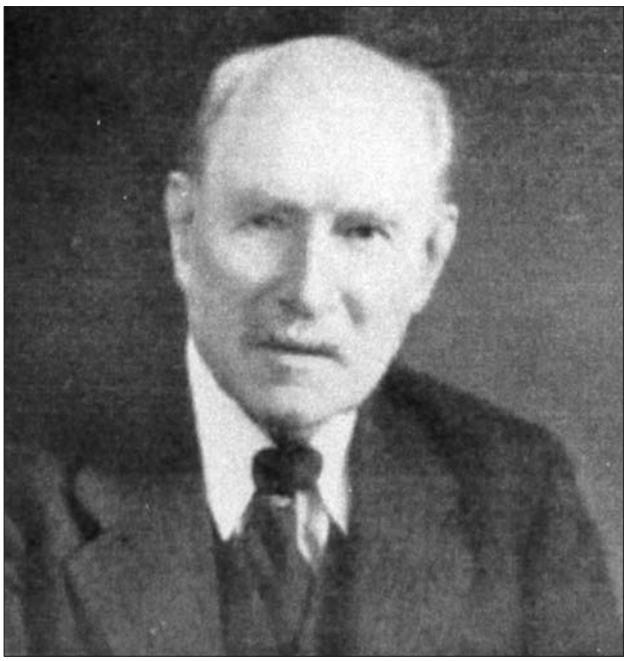

HAFNIUM—No. 72
Mineral containing this New Element, also other Rare Earth Minerals,
CAN BE OBTAINED FROM
JAMES R. GREGORY & CO., *Mineralogists, etc.*,
139 Fulham Road, South Kensington, S.W.3.
Telephone: KENSINGTON, 5841.
Telegrams: "METEORITES, LONDON."

On Friday 2nd February 1923, Readers of *The Times* newspaper turned to page ten and were informed that a new element called hafnium had just been isolated in London. This article followed on from a report of two weeks earlier concerning the metal's detection in Denmark by Dirk Costner & George de Hevesy. It was naturally a matter of pride that the isolation, at least, had been undertaken in this country, and a feather in the cap of the chemist concerned, Dr Alexander Scott. Flushed with success, Scott proposed the name 'oceanium'. *The Times* went on to say '*as a matter of courtesy, a sample has been sent to Hevesy & Costner*'. Unfortunately, subsequent analysis of the sample in Denmark failed to reveal any sign of hafnium.

Scott was not the only one with a little egg on his face over element 72. In 1911 the French chemist Urbain announced the discovery of celtium. Urbain supposed this to be a member of the rare-earths (the lanthanide series) since the sample under examination was a mixture of rare-earth metals. Dauvillier then seemingly confirmed the identification in 1922 by reporting the detection of element 72 in the same sample using X-ray spectroscopy. Urbain maintained his stance that Celtium was element 72 for quite some time after, despite mounting evidence to the contrary.

Costner & Hevesy had good reasons to believe that celtium, if indeed it existed (it didn't), and element 72 were not the same. Apart from other considerations, Bohr's theory of atomic structure predicted that element 71 was the last of the rare-earths so the next element must be considered to be a homologue of zirconium, a member of the titanium group. Thus, they examined extractions from zirconium minerals and were rewarded with a positive identification using Mosley's method. Henry G.J. Moseley in a paper of 1914 had plotted the wavelength of X-ray spectra against the atomic number of known elements and concluded that three elements, lying at various positions between zirconium and gold, had yet to be discovered. The three he identified, with numbers 43, 61, & 75, were subsequently found and named technetium, promethium and rhenium, respectively. Due to an incorrect assumption about thulium being two separate elements, and a couple of misplacements, a vacant space was not, at that time, allocated to element number 72.

Note: The periodic table due to Dimitri Mendeleev (various spellings are to be found in the literature of both his first and second name) published in 1869 was basically arranged in order of atomic weight. It was Moseley's ordering of the elements according to atomic number that cleared up anomalies in the table. Mendeleev made no provision for the Noble Gases as they had yet to be discovered. He did, however, predict the existence of rhenium, to which he gave the provisional name dvi-manganese (second below manganese).



Alexander Scott was born in Selkirk, located in the Borders region of south-east Scotland, on 28th December 1853. He went on to acquire a respectable array of qualifications: a BSc and DSc from Edinburgh University, a BA, MA and ScD from Cambridge University. Durham University presented him with an honorary MA and he was elected to Fellowship of the Royal Society in 1898. He apparently had a phenomenal knowledge of the materials of inorganic chemistry.

James Dewar (whose name is remembered through the Dewar vacuum flask) and Alexander Scott established a close working relationship that first began in about 1872 when Scott acted as Dewar's 'student assistant'. Dewar became a director of the Davy-Faraday Research Laboratory in 1896 and Scott was appointed as Laboratory Superintendent. Much of Scott's work for the next 15 years centred on the determination of accurate atomic weights.

Scott had been examining a black sand from New Zealand that contained mainly $Fe3O_4$ with 25% TiO_2. He noticed that the separated titanium dioxide always gave a small residue, which resisted his efforts to convert it into a soluble compound. After a number of attempts he labelled this substance 'New Oxide' in 1918. On reading of Costner & Hevesy's discovery, he jumped to the conclusion that his mystery substance was an oxide of hafnium. The Times received this information shortly after.

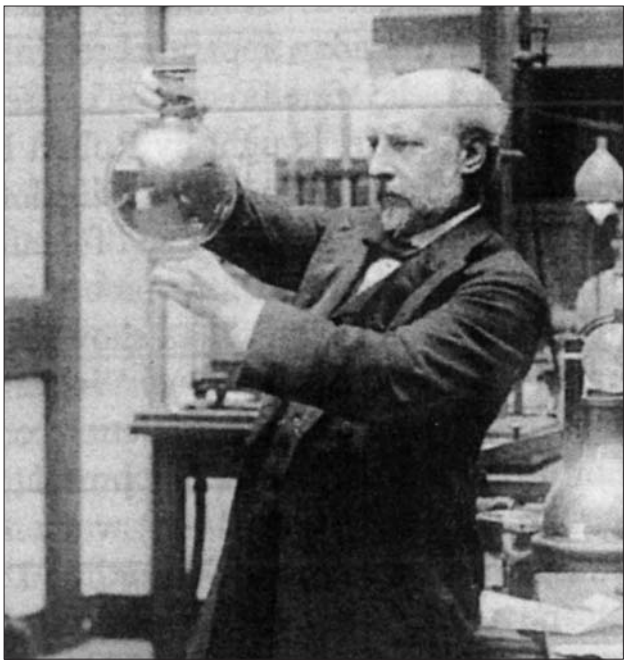
At this time, Scott performed chemical investigations in his own private laboratory at 34 Upper Hamilton Terrace, London N.W.8. His employment at the Royal Institution had been terminated in 1911 after the RI managers decided to do away with the role of laboratory superintendent. This caused much acrimony between James Dewar and Scott, a sad end to a professional relationship that had spanned, on and off, about forty years.

Meanwhile, the researchers in Denmark prepared to do battle with the French scientists in the Urbain camp. Niels Bohr, in whose laboratory Coster & Hevesy had been working, wrote to Ernest Rutherford on the subject. Rutherford replied, referring to Scott as 'a well-known rather elderly chemist' and saying that the report in The Times 'is very wrong and silly'. Bohr had enclosed a letter from Coster & Hevesy intended for publication in Nature. Rutherford weighed the evidence: 'I quite agree…that Urbain has not a leg to stand on.'

After Scott received the report that his samples showed no trace of the new element, he wrote a letter to Nature on 25th April 1923: 'I gladly avail myself of this opportunity of acknowledging and thanking Prof. Bohr and Drs. Coster and Hevesy for all their courtesy and for the very great trouble they have taken to assist me in the elucidation of what appeared to be a real mystery.' And so this acknowledgement, with his best efforts at face-saving, ended the hafnium saga as far as Scott was concerned. The arguments with the French chemists, however, continued to rumble on.

Margery Cook, daughter of the instrument maker Charles William Cook who worked under Dr Scott at the RI until 1905, recalls a visit that her father received before the Second World War. 'I remember Dr Scott looked pretty ancient – he must have been older than my father. The visit created much excitement at the time and what impressed us was that Dr Scott turned up in a chauffeur-driven car. I don't know what they talked about but they liked each other a lot.'

Alexander Scott died at Ringwood, Hampshire on 10th March 1947, aged 93. Sir Robert Robertson (Government Chemist 1921-1936) wrote an article for the Obituary Notices of Fellows of the Royal Society. Of particular note was Scott's association with Howard Carter and the preservation of archaeological treasures from the tomb of King Tutankhamen. Scott visited Egypt in 1924 to advise on the treatment of the ancient relics. Understandably, the hafnium episode was not mentioned.



As an interesting aside, James Dewar managed to fall out with a number of his colleagues. Whilst serving as Jacksonian Professor at Cambridge University he demanded the resignation of his assistant Siegfried Ruhemann who was well liked and respected by other members of the university. Dewar wrote to Ruhemann in 1891 *"In view of the fact that I require the use of the rooms…and that I cannot occupy them until such time as you remove therefrom, I order you to do so forthwith. When I have further need of your services I will acquaint you in due course with my requirements."*

Robert Lennox, a talented engineer who served as Dewar's assistant for many years at the RI, and who lost an eye in the execution of his duties, left after a bitter row. Not everyone painted Dewar as an ogre although working for him certainly had its dangers. John Heath (assistant from 1881– 1925) also lost an eye in a laboratory accident.

Sources

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Thanks to Margery Cook for her recollections of Alexander Scott.

A new venture
Laboratory Design Consultation

Derek Sayers FIScT

Last year, whilst on one of my many annual visits to Malta, I was asked by one of our IST members at the University if I knew of anyone who could advise them on the European Union Regulations which applied to the building of laboratories. Malta had entered the European Union the previous year and therefore any new laboratories would have to conform to European rules.

I immediately thought of IST; I knew many of us in the Institute have been involved in the refurnishing and building of laboratories at our own place of work and were well aware of the regulations in the United Kingdom and Europe. I asked for details so I could formulate a bid on the Tender supplied. I decided that to be sure the job was done properly it was better to have a team made up from people from different parts of the United Kingdom. I asked Simon Fairnie from Edinburgh and Arthur Nicholas from Manchester to join me (from London) in the venture.

The first task was costing the exercise. It was easy to cost possible expenses in Malta because I have an apartment there and I am well aware of the cost of living there. As I have done similar consultancy work abroad before I was fairly certain how long would be required to do the consultation – approximately five working days. However, the cost of travelling to and from Malta would depend on where you were starting from i.e. Scotland, Manchester or London and also the time of year as airfares can vary greatly. We overcame this by entering a bid with travelling expenses left open but a maximum travel cost quoted. I must point out that none of us had the intention of making a lot of money from the exercise, we were happy to spend a week in Malta with all expenses paid. Our bid reflected this and hence, we understand, was far lower than even the local bids.

We answered the Tender outlining our experience and expertise and that there would be a team of three consultants:-

Quote

Overview

- European Union (EU) laboratory furnishing and equipment regulations as they apply
- United Kingdom (UK) laboratory furnishing and equipment regulations as they apply.
- European Safety regulations as they apply specifically to offices and laboratories
- United Kingdom Safety regulations where they apply specifically to offices and laboratories.
- Security installations.
- Laboratory layout and positioning of equipment.
- Sources of specialised equipment.

Breakdown

- The European Union (EU) regulations on laboratory furnishing are subject to interpretation. However other regulations, such as those for electrical wiring, are quite specific.
- The United Kingdom (UK) interprets the EU regulations and incorporates them into its own Health and Safety (H&S) Law. H&S regulations can vary in different parts of the Country and it is for that reason we have consultants from three areas of the UK. Some of the UK regulations may not apply in Malta (for example in the UK gas and electrical fittings must be installed by a qualified and accredited person) but we would advise you of the best practise in those respects.
- There are a number of special EU safety regulations that apply to offices and laboratories a number of which require written Risk Assessments. We can advise you on how Risk Assessments are generated. However you will have to produce 'local' risk assessments to cover each experiment and procedure that include chemicals, apparatus and procedures. We would also advise on the positioning of fire fighting equipment.
- Advice can be given on any extra requirements under UK law.
- Security and safety go hand-in-hand, but in many cases there are no specific security regulations other than those laid down by Insurance Companies. We can advise on how we security is addressed in the UK
- We can advise on the best positioning of equipment.
- We understand that a separate tender for the purchase and installation of furniture will be issued at a later date, however some unbiased independent advice can be offered on equipment and sources of supply.

A written interim Report would be submitted before leaving Malta. However some aspects may require some research. A fuller report would be compiled as soon as possible after returning to the UK

If, in the future, when the furniture and equipment is being installed a site 'inspection' by one of the Consultants is desired, this can be arranged.

Unquote

The work was to be carried out in the first week of February 2006; I arrived a day or two before Simon and Arthur so that I could make sure all was ready in the apartment. Simon and Arthur arrived on the Saturday to start work the following Monday.

The building had already been constructed in "shell" form i.e. the rooms were built but in most cases no services had been installed. Electrical wiring had been

trunked into the building and water and drainage run to each laboratory, but the exact location of each service was yet to be defined. Whilst in the UK, we had been supplied with scaled plans and also a suggested layout for each laboratory.

Over that first weekend we spent many hours discussing the plans and generally making sure that our slightly differing opinions could be 'ironed out' before we met the Department staff on the Monday. Our first task was to make a schedule of work to present to the University on our arrival. There were about 13 laboratories to be designed and also some offices and teaching facilities that were less important. The final schedule differed a little to our initial plans because of the availability of some of their staff.

Monday

1. Tour of the areas
2. Questioning the staff for their individual requirements
3. Individually making notes and photographing areas where necessary
4. In the evening we compared notes and formulated our initial ideas

Tuesday

- Further tour of the areas and questioning of departmental staff and putting forward our joint initial ideas.
- In the evening we modified our ideas based on the discussions with the staff.

Wednesday

- 'Round table' feasibility meeting with Project Team i.e. architects, service providers and departmental staff to discuss our findings. We felt it was no good making proposals that could not be met. Arthur recorded this meeting so we could be sure what decisions had been agreed.
- In the evening we made our final decisions and produced a Powerpoint presentation with hardcopy handouts

Thursday

- We presented a 'PowerPoint' presentation to staff etc. going into considerable detail for each area showing the original design and our proposed modifications. We gave reasons for the modifications and pointed out the various regulations that applied in the UK. We mentioned UK Acts such as COSHH bearing in mind that Malta does not have specific COSHH Regulations nor does it carry out Risk Assessments at the moment.

Friday

- This was a free day to relax, the first three days of the week we had been working in the Apartment each evening sometimes until the early hours of the morning formulating the next day's events.

Saturday

- Simon and Arthur returned home – I stayed on to clear up the apartment

On returning to the UK we submitted a full 30 page Report. The Report was in two Sections

Section I An overview of, and feedback from the meetings and workshop presentation with the project team and clients

This was separated into the following parts:

- General furniture and fittings
- Services – Mechanical
- Services – Electrical
- Services – Plumbing
- Building – General
- Management issues

For each point we mentioned the discussion and whether our proposal had been confirmed by a named member of their Project team

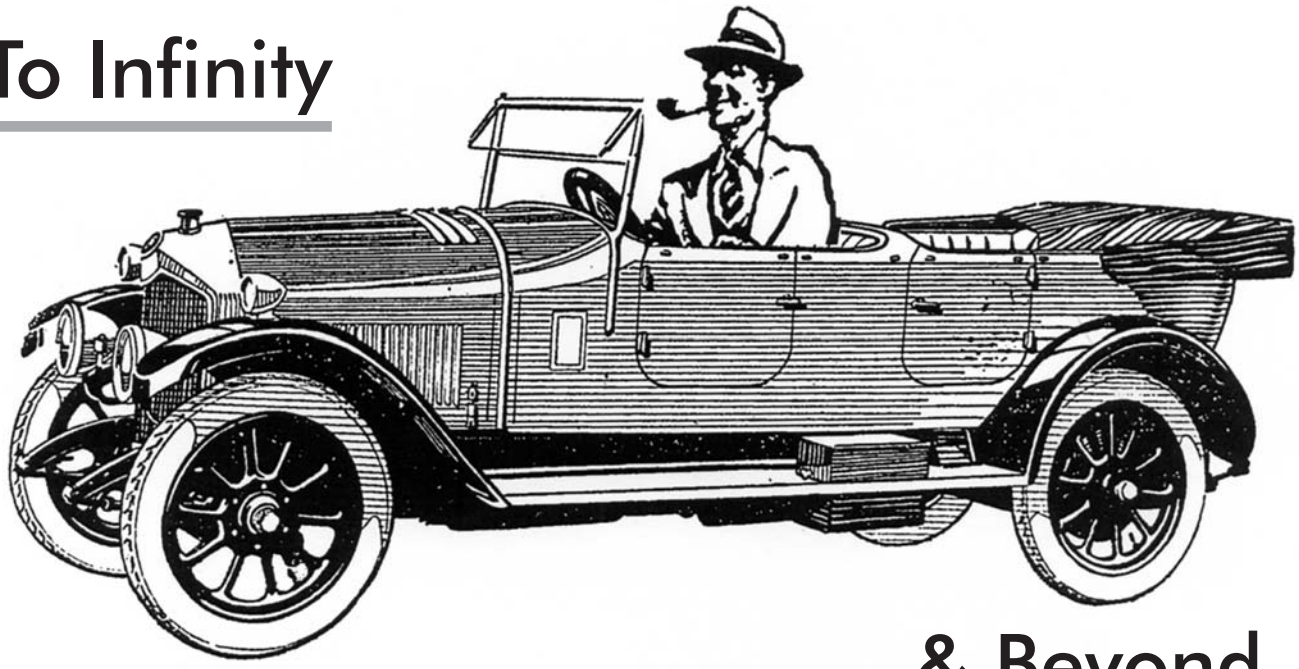
Section II Laboratory designs before and after our proposals.

The Report was comb-bound and a number of copies were sent to Malta.

My sincere thanks to both Arthur and Simon; it proved invaluable to have a team rather than one person especially as we came from different parts of the UK and had slightly differing views. It became clear that European Regulations and indeed some UK Regulations are open to differing interpretations. Having a team certainly overcame this problem and we received a letter of appreciation from Malta. I believe this is a service that some of us in the Institute of Science Technology especially to developing countries abroad. We look forward to further requests.

Bronze medal presented to each of us during our visit to the University of Malta

To Infinity



& Beyond

Alan Gall, IST Archivist

Thanks to Neil Richardson, Local History Publisher, for the drawing.

An exceptionally brilliant and devilishly handsome young physicist sets out one morning for his laboratory at a steady 30 miles per hour. The car almost drives itself, which is just as well because his mind is on other things. As he leaves his home and takes to the open road, visions of fame, fortune, honorary degrees and a Nobel Prize flash before his eyes – for he has just invented a matter transmitter. After a few hours of tinkering at the lab the final adjustments are made to his machine so that a human subject can be sent instantly to any required destination. In the best spirit of scientific discovery, he decides to be the guinea pig himself and on stepping into the 'Trans-O-Mat' is conveyed back to his own house at the press of a button.

What will be his average speed for the total journey from home to laboratory and back again?

The calculation is straightforward but for the moment let us go back a week in time to the previous Tuesday when our scientist drove to the lab at the same 30 mph then, due to poor road conditions, returned at the slower speed of 20 mph. What was his average speed then? It is tempting to take an average of the two figures:

$$\frac{30 + 20}{2} = 25 \text{ mph}$$

However, the appendix shows that the correct calculation is:

$$\frac{2 \times 30 \times 20}{20 + 30} = 24 \text{ mph}$$

Now let us apply the formula from the appendix to the original problem. Note that an instantaneous journey must be completed at infinite speed. Basic mathematics tells us that infinity multiplied by anything, or added to anything, is still infinity (we shall not cloud the issue by considering the latest ideas about large and small infinities). Thus, the formula will give infinity divided by infinity. Not to worry, we can divide top and bottom of the expression by C to give:

$$A = \frac{2 \times B}{B/C + 1}$$

B/C will be zero since C is infinitely large and so A = 2 x 30 = 60 mph.

If we had tried to take a simple average of infinity and 30 mph, we would be more than a little wide of the mark with our solution.

Alternatively, suppose that the distance is 60 miles each way (any distance can be used, they all give the same result).

Time to cover 60 miles at 30 mph = 2 hours

Time to cover 60 miles at infinite speed = 0 hours

$$\text{Total distance covered} = \frac{120}{2} = 60 \text{ mph}$$
$$\text{Total time taken}$$

Now try this version of the problem. A man drives to work at 30 mph. His colleague makes a bet that he can't drive back home fast enough to average 59 mph overall. What speed would be required to win the bet?

Transposing the equation from the appendix gives –

$$C = \frac{A \times B}{(2B\text{-}A)} = \frac{30 \times 59}{(60 - 59)} = 1770 \text{ mph}$$

He would need to travel at over twice the speed of sound.

Clearly, some seemingly simple situations are not what they appear at first sight. Take, for example:

$$Y = \frac{1 - X^2}{1 - X}$$

What is Y when X = 1?

The bottom line 1 – X will become zero and dividing something by zero will give infinity. But in this case that something is $1 - X^2$ which is also zero. How are we to interpret 0/0? Is it zero or infinity? Neither, the answer is two.

We could have arrived at a good idea of the solution by putting in a few values of X close to 1 and observing the effect on Y.

Trial value	X	Y
	0.9	1.9
	0.99	1.99
	0.999	1.999

It's not difficult to see that Y is approaching a value of two as X gets closer to one.

A better method is to use a little algebra.

Since $1 - X^2 = (1 + X)(1 - X)$ then:

$$Y = \frac{(1 + X)(1 - X)}{(1 - X)}$$

Cancel the (1 – X) terms, top and bottom, to give Y = 1 + X = 2 when X = 1

If $Y = \frac{1 - X^n}{1 - X}$

What is the solution when the power n can take any real value?

The mathematician would probably use a useful tool called l'hopital's rule. When 0/0 occurs, the trick is to differentiate top and bottom independently giving:

$$Y = \frac{-n X^{n-1}}{-1} \text{ when } Y \longrightarrow 1$$

So when X = 1, Y = n

If you have reached this far, I hope that this article has shown how a simple bit of maths can be used for entertainment.

APPENDIX

Let A = average speed over a complete journey of distance 2d

B = speed of outward journey over a distance d

C = speed of return journey over the same distance d

Then the time taken for the outward journey is B/d, and C/d for the return

$$A = \frac{\text{Total distance}}{\text{Time taken}}$$

$$= \frac{2d}{(B/d + C/d)}$$

$$= \frac{2BC}{B+C}$$

IST New Members/Upgrades October 2005 – September 2006

NEW MEMBERS LIST

Membership No	Members Name	Grade
T14523	OSAYANDE, Kingsley	MIScT
T14524	AKPEKPE, John A	MIScT
T14525	ONWASIGWE, Daniel C	ASSOC IScT
T14526	ADENUBI, Latifat Adetutu	MIScT
T14527	INEBEDION, Francis	ASSOC IScT
T14528	SHITTA, Akorede Kazeem	ASSOC IScT
T14529	OBASUYI, Emmanuel I	ASSOC IScT
T14530	ZERENDU, Robert S	MIScT
T14531	ISHOLA, Rasheed A	ASSOC IScT
T14532	KOLAWOLE, Folakemi M	Assoc IScT
T14533	ADEBOWALE, Adedotun D	MIScT
T14534	MOMODU, Saliu Aigbodion	ASSOC IScT
T14535	ALLTON-EVANS Karen Anne	MIScT & Reg Sci Tech
T14536	MOJIMINIYI, Utibe Edet	MIScT
T14537	GALL, Robin	ASSOC IScT
T14538	OSUMILI, Henry Nduka	ASSOC IScT
T14539	NIBLETT, Roy	ASSOC IScT
T14541	LAWAL, A Yakubu	MIScT
T14542	MODELE, Shehu A	MIScT
T14543	OWULAH, Caleb	MIScT
T14544	REID, Carl Michael	MIScT
T14545	SERGHI, Xenakis	MIScT
T14546	NICHOLLS, Sarah	MIScT
T14547	LEESE, Alison Mary	MIScT
T14548	KINGS, John	MIScT
T14549	BEVERIDGE, Christine	MIScT
T14550	CARTER, Kevin	MIScT
T14551	OLASEHINDE, Abraham	MIScT
T14552	AKINSINDE, Kehinole Adewale	MIScT
T14553	HOPPER, Michael	MIScT
T14554	GLYNN, Michael	MIScT
T14555	YOUSTER, Janine	MIScT
T14556	AMADI BENSON, Victor	Assoc.IScT
T14557	BAJOMO, Olufemi Kayole	MIScT
T14558	TAYLOR, Colin Kenneth	MIScT
T14559	OGBE, Obiwe Simon	MIScT
T14560	EDUAFO, Kodjo Meinster	Assoc.IScT
T14561	ARMAH, Daniel	Assoc.IScT
T14562	ASARE, Eugene Koranteng	Assoc.IScT
T14563	KOTEY, Ashalley Nathaniel	Assoc.IScT
T14564	AGUEBOR, Benjamin Ehi	MIScT
T14565	AYANRINDE, Murtala Babs	MIScT

REINSTATEMENTS

T13361	LAM, Wai Shung	Assoc.IScT

43 in Total

UPGRADES

T10905	CROFT, Terry	FIScT
T14002	HOWES, Diane	MIScT
T14484	ELHARDALLO, J M	FIScT
T13340	PORTELLI, Joseph	FIScT
T5642	OGUNYEMI, Ebenezer	FIScT
T14299	MOULSON, Ian	FIScT

6 in Total

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HAYS
Education

The Changing Face of the Lab Technician in Schools and FE

As demand for effective teaching support staff in schools has increased over the past few years, a wide range of schools and Further Education Colleges have found it increasingly difficult to source candidates with the necessary skills and experience for their technician vacancies. Between 2004 to 2005 and 2005 to 2006, We (Hays) alone as a company have seen a 30% increase in the number of science technician vacancies registered with them. The demand for quantity and quality of applicants has been driven by a number of key factors:

In September 2003, the first phase of the government's workforce reform bill came into being, re-assigning 24 non-teaching tasks from teachers to support workers. The impact on this for science departments involved an increased need for support in a number of areas, including setting up of equipment, managing materials, teaching resources and stock ordering. It was therefore necessary for many science departments to expand their team of technicians to accommodate the additional workload.

Other government strategies, including the move towards specialist college status in the sciences and projects such as Building Schools for the Future, have had an impact of the physical growth in school science departments. This expansion in buildings and resources has sometimes seen a science department with three working laboratories transformed into one of double that size. And again, it has been imperative for schools to increase the number of technicians in school to support the new resources, facilities and additional teaching.

It is also widely recognised that technicians may also provide expertise that teachers do not have, due to their academic or vocational studies. Attracting technicians from commercial

backgrounds can bring latest industry knowledge to a school or college science department and enrich the learning experience of students

So why are these educational institutions often turning to an education recruitment agency to find this new workforce?

One high profile reason is the huge responsibility that schools and Further Education Colleges face to ensure child protection and the protection of vulnerable adults, particularly with the recent DfES regulations on effective record keeping of clearance checks on staff. The procedures that a company, such as ourselves, have in place to vet school staff enables us to provide fully vetted candidates at a moments notice. The consultancy side of the process is also enormously important. We can listen to an individual department's needs and shortlist suitable candidates to best fit the role. As we often have several technicians in any geographical area seeking work at any one time, this service saves considerable time for heads of departments and senior technicians - alleviating a situation immediately where they are trying to 'manage' with one member of staff down. The fact that we can supply experienced technician staff means that they have someone who is aware of health and safety regulations and relevant legislation, requiring only training on aspects of working in that particular school environment.

With such extensive changes in the culture of education, there is considerable development in terms of the range of career opportunities available to technicians. If you would like further information about our involvement in this field, Becky Whiteman (a business manager at Hays Education) is happy to provide additional or answer any questions. Contact details: 0121 236 7933 or becky.whiteman@hays.com. Website: www.hays.com/education

Hays not only provide specialist recruitment and HR services but also offer support for a variety of organisations in other ways eg. providing sponsorship for one organisation's "Technician of the Year Award". Hays (Education) and IST are also currently in discussion to explore ways in which the two organisations can collaborate in the future.

Hays Education is a division of Hays, a global leader in specialist recruitment and HR services and is committed to providing schools and nurseries across the UK with high quality vetted staff. Hays Education has 28 offices nationwide, 13 LEA partnerships and preferred supplier agreements with a number of education authorities throughout the UK including London and Birmingham.

Specialist Recruitment hays.com/education

Au Revoir Lichfield - Hello Sheffield

If you have visited our web site recently you may just have noticed that we have moved offices - yet again! You might be forgiven for thinking "Oh no, not more change"; in a short space of time we have moved from Stowe House to Brooke House and then to Kingfisher House, and all this on top of sweeping changes to the Bylaws and radical re-structuring of our administration. This time we have moved north to Sheffield (see this issue for our new address) and the executive considered a number of options before making this decision.

Change is a feature of life. Mostly it is viewed with suspicion and unease, but if we are honest, this aspect is usually because the change is forced upon us. We are all happy with change when we are in control. When we can clearly see the need, when we can understand the reasons; new car, redecorate the lounge, chuck out the chintz. There is always a risk to change and the executive have been mindful of this throughout. We need to minimise the risk of disruption, consider the inconvenience to some, the benefit to others, the possibility of loss of continuity and contacts. But we believe the Institute has to move on and we are convinced that this latest move will place us in a strong and flexible position for the future.

So, we are pleased to introduce Wendy Mason and Louise Taylor who will be answering the phone next time you call. We are confident that you will enjoy first class, fast and efficient service and a friendly voice to talk to. Wendy and Louise will be working closely with Joan Ward who will be looking after the administrative side of things. Joan has been an IST member for some time and after a successful career in the laboratory moved on to develop considerable skills and experience in business and financial management.

But before we move on to the future, let's take a moment to remember the past. We have enjoyed excellent accommodation and support from ILM and when that came to an end following their merger with City and Guilds, we were most fortunate that CAATS administration in the form of Peter Grice and Ann Randall were able to take over and look after our best interests. CAATS and PAA/VQSET have a close relationship and in as much as PAA are the awarding body for our technical certificate it's very much *au revoir* rather than goodbye.

So what next?

A fundamental question indeed, but the answer, surprisingly perhaps, remains unchanged; back to what we are all about; looking after our members and promoting the profession. The next question of course is how? Well Terry Croft and the Marketing Board have come up with some exciting new ideas, which we alluded to in the last news letter.

After some market research and taking feedback from members and non-members we have produced the new publicity material and designs. We have decided to recruit "specialist, technical and managerial staff" and to reach out to those with technical skills who may not necessarily be involved with science. There are many with technical skills in the arts, IT and other areas and these will be represented in future.

What else can we offer prospective members?

We think that our members will find it useful to be able to to get help and support with their career and development so we have written to all our Fellows to ask if they would be happy to act as mentors for those in the earlier stage of their careers. Well over half responded positively so we will be developing a framework to accommodate this interaction between the young and the not so young.

Am I fellowship material? Only one way to find out!

If you are already established in your career you might want to consider applying for a fellowship. We have streamlined this process and made it easier to apply; a simple form and a full CV are all that are required. Guidance and criteria are available on the web site. The ethos and high standards required remain unchanged but we have cut a swathe through the admin and removed the application fee so let's have lots of applications!

What we really need is more new blood in the Institute; people who are in the early stages of their careers, but in these days of political correctness and age discrimination I'm not sure I can say that (but I have!). The reality of the situation is that our age profile is heavily skewed to those who are approaching retirement – so much so that in a few years there will be a rapid decline in our numbers.

Significant numbers of new members (young and old equally welcome!) are crucial to our future success so we want a serious recruitment drive and you can all play a part. And just as a tempter we will be offering a

£10 Marks and Spencer voucher

to every member who recruits a new member. And just to show we are really serious, the member that introduces the most new recruits will receive

£100 worth of Premium Bonds

All you have to do is visit the web site or email office@istonline.org.uk with the email address of the person(s) you have recruited and once they have joined we will send you your wedge. Get busy now and cheer up your Christmas!

In addition to all this we are looking at our Prize fund to see how it can help our members develop and have already approached members in the early stages of their careers to submit articles for the journal. The best article(s) will be published and will win a

Prize of £100

for the author. We are delighted to be able to publish the first of these in this issue – and it's a big one! So big, in fact, that it will have to be finished in the next issue. Before you dismiss your chances of winning as unlikely, just bear a thought about our membership numbers; if you are in the early stages of your career you will be one of not many. The chances of publication of a well written and interesting article are actually quite high, so get creative and put something together!

John Robinson FIScT, MInst.LM

A Dictionary Of International Units

Metric-Matters Names and Symbols.

compiled by Philip Bladon FIScT

ISBN - 1 3: 978-0-595-371 1 5-0 (paperback) USA $12.95 UK £8. approx

ISBN - 13: 978-0-595-81 51 5-9 (ebook) $6.00

This dictionary provides information for everyone:

- Trivia and Scrabble buffs can enrich their vocabulary;
- Symbologists and symbolists can ponder over character sizes;
- An essential reference source for science students.
- Discover the 19 scientists of six nationalities whose surnames have been used for SI (metric) units.
- This dictionary gives the twenty SI prefixes with guidance on how to write units, names, symbols, and numerical values correctly.
- Metric-Matters introduces you to 'Le Systeme International d'unites' (designated SI in all languages). This is the International Standard.

The author, Philip Bladon FIScT, is a teacher with many years experience overseas.

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Selection of Laboratory Disinfectants

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Introduction

In order to achieve microbial control in laboratories the use of defined cleaning techniques, together with the application of detergents and disinfectants, is of great importance. The use of such detergents and disinfectants is a step towards control of contamination however the use of cleaning solutions should not merely cover up poor practices.

This article examines cleaning, detergent and disinfection agents available for use in different laboratories. The focus is upon detergents and disinfectants used for the cleaning and reduction of micro-organisms from surfaces, although a reference is also made to hand sanitisation. By micro-organisms the referral is to vegetative bacteria and fungi, and those bacteria capable of endospore formation. No specific reference is made towards bacterial toxins or to viruses (it is important to note that the antibacterial activity of a disinfectant does not necessarily result in antiviral properties).

Important concepts

In order to examine different types of detergents and disinfectants it is important to understand some key concepts: cleaning, detergent, disinfectant, sanitiser and antiseptic.

Cleaning

Cleaning, in the context of laboratory use, is the process to remove residues and 'soil' from surfaces to the extent that they are visually clean. This involves defined methods of application and often the use of a detergent. Cleaning steps are often necessary prior to the application of a disinfectant for it is essential that a surface or item of equipment has been properly cleaned before the application of a disinfectant in order for the disinfectant to work efficiently.

Cleaning can arguably be seen as a form of disinfection in its own right as the cleaning process, can remove or dilute microbial populations and many detergents have chemical additives that can 'disinfect'.

Detergent

A detergent is a chemical used to clean equipment or surfaces by removing unwanted matter (often referred to as 'soil'). Detergents generally work by penetrating soiling and reducing the surface tension (which fixes the soil to the surface) to allow its removal. Detergents also contain differently charged ions that can cause micro-organisms to repel each other. This repulsion causes the micro-organisms to disassociate from the surface and become suspended. Suspended micro-organisms are easier to remove from the surface by the rinsing effect of the detergent (or a subsequent water rinse) or to be destroyed by applying a disinfectant.

Disinfectants

A disinfectant is a chemical agent, from a very diverse group of products, which reduces the number of micro-organisms present (normally on an inanimate object). There are various 'official' definitions of the process of disinfection and disinfectant agents, one of the simplest is from the 1998 ISO standard on Aseptic Processing (ISO 13408-1[i]), where a disinfectant is defined as:

"[a] chemical or physical agent that inactivates vegetative microorganisms but not necessarily highly resistant spores"

There are various different types of disinfectant with different spectrums of activity and modes of action. Disinfectants have differing efficacies. Some are *bacteriostatic*, where the ability of the bacterial population to grow is halted. Here the disinfectant can cause selective and reversible changes to cells by interacting with nucleic acids, inhibiting enzymes or permeating into the cell wall. Once the disinfectant is removed from contact with bacteria cells, the surviving bacterial population could potentially grow. Other disinfectants are *bacteriocidal* in that they destroy bacterial cells through different mechanisms including structural damage to the cell; autolysis; cell lysis and the leakage or coagulation of cytoplasm. The destruction of fungal spores is a property which a given disinfectant may or may not possess [v]. The process of disinfection is performed using manual or mechanical (automated methods), such as, a Clean-in-Place (CIP) system which might feature as part of an item of laboratory equipment.

Within these groupings the spectrum of activity varies with some disinfectants being effective against vegetative Gram positive and Gram negative micro-organisms only while others are effective against fungi. Some disinfectants are *sporicidal* in that they can cause the destruction of bacterial endospores. However, a chemical agent does not have to be sporicidal in order to be classed as a 'disinfectant' or as a 'biocide'.[ii]

The bacteriostatic, bactericidal and sporicidal properties of a disinfectant is influenced by many variables, not least their active ingredients , which are examined later.

Sanitiser

The term sanitiser is open to different interpretations. Within Europe, it is normally taken to be an agent that both cleans and disinfects (normally a disinfectant that contains a cleaning agent). Within North America, however, the term is normally applied to a straightforward disinfectant. Sanitisation is a general description for reducing a microbial population. Disinfection is a more precise term in that the chemical agent must reduce a known number of micro-organism (a property demonstrated through validation).

Antiseptics

The use of hand disinfectants is part of the process of contamination control for personnel working in cleanrooms. Sometimes these are classified as antiseptics. Because of the association of antiseptics with the treatment of wounds as opposed to the context of this chapter on the sanitisation of hands for people working in clean rooms the term 'hand disinfectant' will be used.

Types of disinfectants and detergents and factors to consider in their selection

There are many different types of disinfectants and detergents for use within the laboratories [iii]. These types differ by their mode of activity, efficacy, compatibility, cost and when judged against current health and safety standards. These factors need to be considered as part of their selection.

Disinfectants

Types of disinfectant and activity

There are a number of different types of disinfectant with different modes of activity and of varying effectiveness against micro-organisms. These different disinfectants also have varying modes of action against microbial cells due to their chemical diversity. Actions against the microbial cell include: acting on the cell wall, the cytoplasmic membrane (where the matrix of phospholipids and enzymes provide various targets) and the cytoplasm. Some disinfectants, on entering the cell either by disruption of the membrane or through diffusion, then proceed to act on intracellular components. There are different approaches to the categorisation and sub-division of disinfectants including grouping by chemical nature, mode of activity or by -static and -cidal affects on micro-organisms. This chapter discusses some of the more commonly used disinfectants employed in the pharmaceutical environment by categorising them according to their chemical properties. The two principal categories used are the division into oxidising and non-oxidising chemicals. The list below is not selective [iv v vi].

Non-oxidising disinfectants

The majority of this group of disinfectants have specific modes of action against micro-organisms but generally they have a lower spectrum of activity compared to oxidising disinfectants [vii].

i) Alcohols

Alcohols have an antibacterial action against vegetative cells. The effectiveness of alcohols against vegetative bacteria and fungi increases with their molecular weight (therefore ethanol is more effective than methanol and in turn isopropyl alcohols more effective than ethanol). Alcohols, where efficacy is increased with the presence of water, act on the bacterial cell wall by making it permeable. This can result in cytoplasm leakage, denaturation of protein and eventual cell lysis (alcohols are one of the so called 'membrane disrupters'). The advantages of employing alcohols include a relatively low cost, little odour and a quick evaporation. Furthermore alcohols have a cleansing action. However alcohols have a very poor action against spore formers and can only inhibit spore germination at best [viii].

ii) Aldehydes

Aldehydes include long chain chemical compounds, such as, formaldehyde and gluteraldehyde. Gluteraldehyde is a very effective disinfectant (and sterilant) through acting on cell wall proteins. Glutaldehyde has a wide spectrum of activity and is effective against bacterial and fungal spores. However gluteraldehyde is little used today due to health and safety concerns. Formaldehyde and o-Phthaladehyde are slightly less effective due to a slower rate of reaction but possesses an equally wide spectrum of activity. Aldehydes have a non-specific effect in the denaturing of bacterial cell proteins and can cause coagulation of cellular protein [ix].

iii) Amphoterics

Amphoterics are acidic and have a relative wide spectrum of activity, but are limited by their ability to damage endospores. Amphoterics are frequently used as surface disinfectants. An example is alkyl di(aminoethyl) glycine or derivatives.

iv) Acid anionics

Acid anionics are weak acids with a relatively limited spectrum of activity and are very pH dependent. An example of this group is carboxylic acid. They are not effective against fungi or spore forming bacteria. Their bactericidal properties arise from their ability to cause bacterial cell disruption through proton motive force where the balance of hydrogen across the cell is disrupted which, in turn, affects cellular division by disruption of oxidative phosphorylation.

v) Biguanides

Biguanides are polymers supplied in salt form, such as chlorhexidine, alexidine or hydrochloride. Biguanides have a relatively wide spectrum of activity with the exception of killing endospores. The group are limited by only being truly effective at an alkaline pH and are rarely effective under acidic conditions. Biguanides affect the bacterial cell membrane, enter the cell through diffusion, and cause cell disruption and cytoplasm leakage.

vi) Phenolics

Phenols are produced from the fractionation of tar and are among the oldest scientifically evaluated disinfectants dating back to Robert Koch's evaluation of phenol's bactericidal effect against *Bacillus anthracis*. The commonly used phenolic is basic phenol (carbolic acid) although synthetic variants are being widely used. Phenol can be made more complex by the addition of halogens such as chlorine (the bis-phenols and halophenols) to make compounds like triclosan and chloroxylenol. Phenols are bactericidal, and antifungal, but are not effective against spores. Some phenols cause bacterial cell disruption through proton motive force others attack the cell wall and cause leakage of cellular components and protein denaturation .

vii) Quaternary ammonium compounds (QACs)

QACs are cationic salts of organically substituted ammonium compounds and have a fairly broad range of activity against micro-organisms, albeit more effective against Gram-positive bacterium at lower concentrations than Gram-negative bacteria. They are considerably less effective against spore formers. QACs are sometimes classified as surfactants. An example is benzalkonium chloride. QACs are the most widely used of the non-oxidising disinfectants within the pharmaceutical industry. Their mode of action is on the cell membrane leading to cytoplasm leakage and cytoplasm coagulation through interaction with phospholipids.

Oxidising disinfectants

This group of disinfectants generally have non-specific modes of action against micro-organisms. They have a wider spectrum of activity than non-oxidising disinfectants, with most types able to damage endospores, but they pose greater risks to human health.

i) Halogens

Halogens are among the oldest identified disinfectants and include organic and inorganic varieties. They can be divided into chlorine releasing and iodophors. Both types have a broad spectrum of activity against a range of micro-organisms and are normally effective sporicides. Examples of chlorine releasing chemicals are sodium trichloroisocyanurate, sodium hypochlorite and chlorinated trisodium phosphonate. Hypochlorites are one of the oldest commercial disinfectants. The mode of action of this group is not completely known [iv].

Iodine is another disinfectant with a long history. Most commercial iodine based disinfectants consist of iodine formulated with surfactants or polymers in an acidic solution. The effectiveness of iodine disinfectants is determined by the amount of free I_2. Iodine acts by iodinating tyrosine residues in cells. The disadvantage of iodine is its ability to stain and unpleasant odour.

ii) Oxidising agents

This set includes oxygen releasing compounds like peracetic acid and hydrogen peroxide. They are often used in the gaseous phase as surface sterilants for equipment. These peroxygens function by disrupting the cell wall causing cytoplasm leakage and denature bacterial cell enzymes through oxidation. These oxidising agents have advantages in that they are clear and colourless, thereby avoiding staining, but they do present some health and safety concerns particularly in terms of causing respiratory difficulties to unprotected users.

(This article by Tim Sandle will be continued in the next issue)

Institute Regalia

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Reverse of cover page.

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The Journal

Summer 2006

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