SSERC Bulletin

Ideas and inspiration supporting science and technology for all Local Authorities

No. 259 - Summer 2017

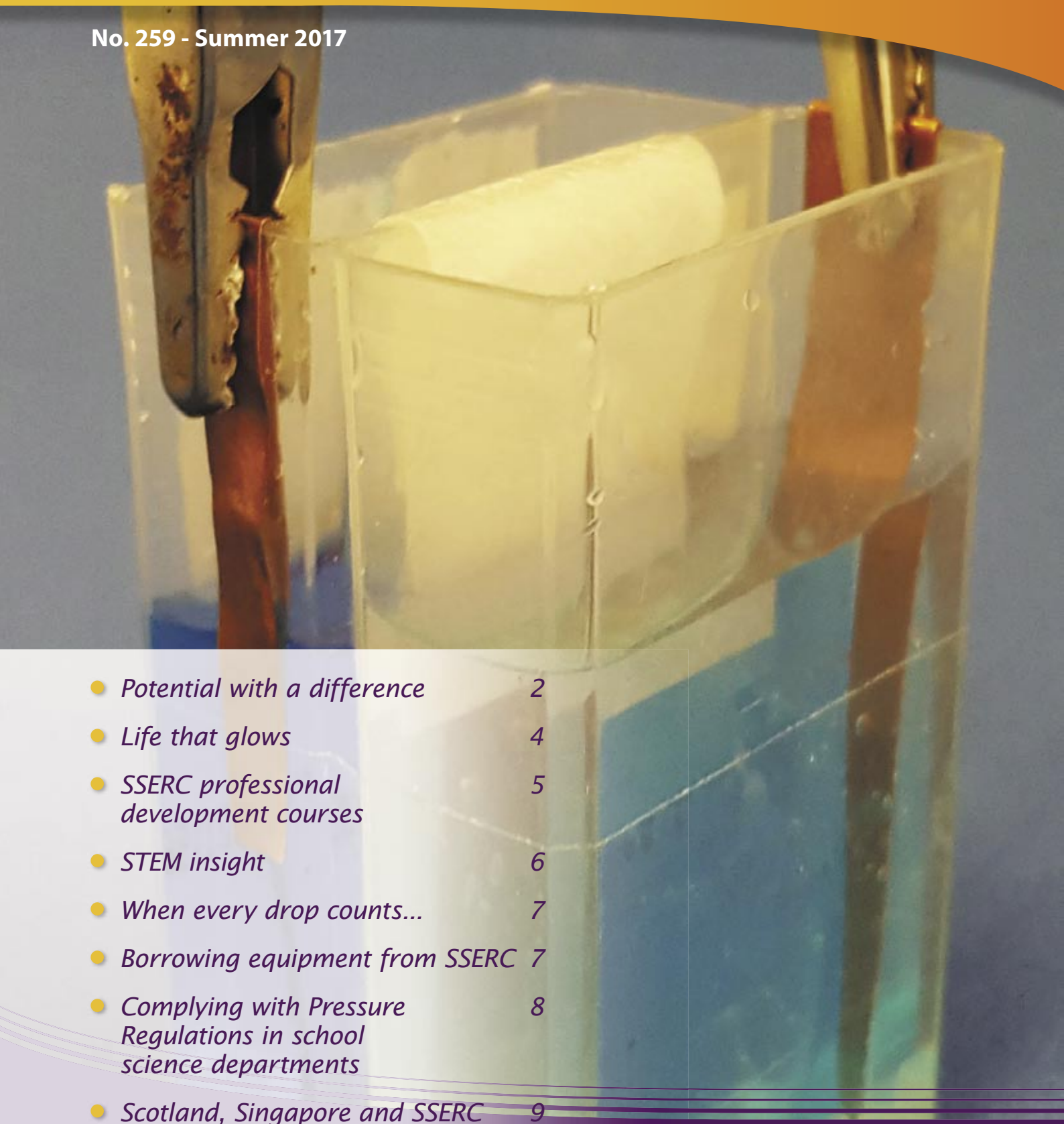

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Figure 1 *- Volta's pile.*

Potential with a difference

Chemistry is, by and large, the study of processes that involve the movement of electrons between atoms (or between energy levels in the same atom). It is possible, of course, for electrons to move in other ways. Most commonly, electrons can flow along wires in the form of an electric current.

Electrochemistry is the study of chemical processes that cause electrons to move. This movement of electrons can be generated by movements of electrons from one element to another in a reaction known as an oxidation-reduction ("redox") reaction.

It all began with Italian physician and anatomist Luigi Galvani who marked the birth of electrochemistry by establishing a link between muscular contractions and electricity in 1791 when he proposed a "nerveo-electrical substance" in life forms as a result of observing the twitching legs of a frog he was dissecting.

Alessandro Volta, professor of physics at the University of Pavia, was not convinced by Galvani's explanation of his observations. He suggestead instead that the contact of dissimilar metals was the true source of the stimulation and referred to the electricity so generated as "metallic electricity" and decided that the muscle, by contracting when touched by metal, resembled the action of an electroscope. Furthermore, Volta claimed that if two dissimilar metals in contact with each other also touched a muscle, agitation would also occur and increase with the dissimilarity of the metals.

In 1794 Volta showed that when two metals and brine-soaked cloth or cardboard are arranged in a circuit they produce an electric current. In 1799, he stacked several pairs of alternating copper and zinc discs (the electrodes) separated by cloth or cardboard soaked in brine (the electrolyte) to increase the electrolyte conductivity (see Figure 1). When the top and bottom contacts were connected by a wire, an electric current flowed.

This 'voltaic pile' was the first electrical battery that could provide a continuous electric current to a circuit. It revolutionized chemistry enabling a rapid series of discoveries including: the electrolysis of water into oxygen and hydrogen (1800) and the discovery or isolation of sodium (1807), potassium (1807), calcium (1808), boron (1808), barium (1808), strontium (1808), and magnesium (1808).

The discoveries above were made by using electrolytic cells, where passing an electric current causes a reaction to take place. In this article, we are dealing with Galvanic (or Voltaic) processes. These are defined as chemical reactions that result in the production of electrical energy. These reactions lie at the heart of battery technologies and thus have a vital and ever more important role in modern, mobile electronic devices and in energy storage.

A Galvanic cell is a device consisting of a single pair of electrodes connected via conducting liquids, electrolytes, that converts chemical energy into electrical energy.

In such cells, the electrodes can sometimes use the same electrolyte but more often the process needs to be divided between two containers known as 'half cells', each containing only one of the electrodes, linked with a conductive 'salt bridge' allowing non-metal ions to move between the cells to maintain the charge balance. When the right connections are made, a spontaneous redox reaction takes place which is responsible for the production of electrical energy. A simple schematic is shown in Figure 2.

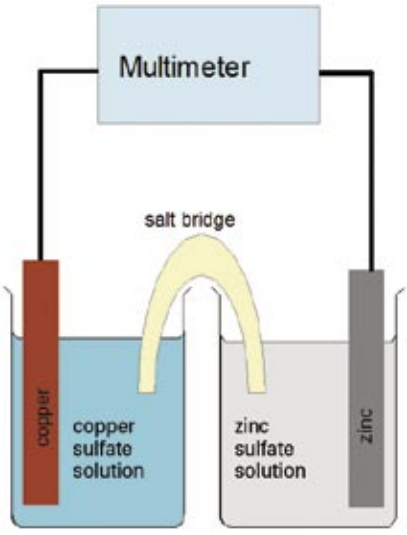


Figure 2 *- A circuit of two half-cells.*

Where does it fit?

***CfE* Level 2 - 10a**
To begin to understand how batteries work, I can help to build simple chemical cells using readily-available materials which can be used to make an appliance work.

CfE Level 3 - 10a
I can help to design simple chemical cells and use them to investigate the factors which affect the voltage produced.

National 3 - properties of materials
Set up and use a lead-acid cell. Demonstrate that electrical energy can be obtained from a chemical reaction.

National 4 - properties of metals and alloys
Pairs of metals to determine electrochemical series. 'Fruity' batteries using different metal pairs. Simple cells.

National 5 - metals
Make a lead/acid cell to show a rechargable battery. Ion-electron equations can be written for electrochemical cells including those involving non-metals. Combinations of these reactions form redox equations.

In this article, we aim to show how it is possible to make and investigate electrochemistry on a small scale using simple and cheap half cells made from 'tic-tac' boxes. (Pupils can readily be persuaded to eat the contents!). If two are placed side by side (possibly taped together) it is easy to set up simple half cells using only about 15 cm^3 of electrolyte and some small strips of different metals. A simple salt bridge can be made by simply placing a folded piece of filter paper soaked in a salt

Figure 3 *- Tic-tac half-cells.*

Figure 4 *- Simple lead-acid accumulator.*

such as potassium nitrate, between the two half cells. A sample set-up can be seen in Figure 3.

Using this apparatus (or variations on it) it is possible to carry out a range of investigations:

- The voltages generated can be determined by use of a voltmeter or a suitably set multimeter.
- Current generated can also be determined by using a multimeter or investigated more indirectly by using cells to power devices such as low power solar motors.

It is possible to look at a range of factors that might affect the voltage and/or current generated such as:

- The type of metal.
- The size and shape of the electrodes.
- The type, volume and concentration of the electrolyte.
- The design of the 'salt bridge'.
- Putting cells together in series or parallel.

Beyond that, it is possible to look at some other types of cells such as

Rechargeable lead/acid cells

Using a single tic-tac box (or other container) with two lead electrodes, the cell can be charged with a low voltage dc power source (or battery) and used to drive a solar motor or similar (see Figure 4). The relationship between charging voltage, current or time and the length of time the motor will turn can be the basis of an interesting investigation.

Concentration cells

While these have no commercial importance, they are useful in helping to model how voltages can be generated in biological systems such as nerve cells.

Once again two tic-tac boxes are used to produce two half cells but this time the electrodes are both made of the same metal. The electrolytes in the two half-cells are solutions of the same salt but at very different concentrations. Once again they are joined by a salt bridge (see Figure 5). When the circuit is completed, a small voltage and current is generated. The effect of changing electrodes, electrolytes and concentrations can be investigated as before.

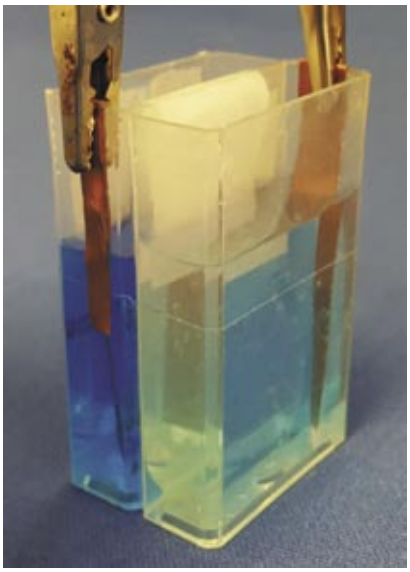
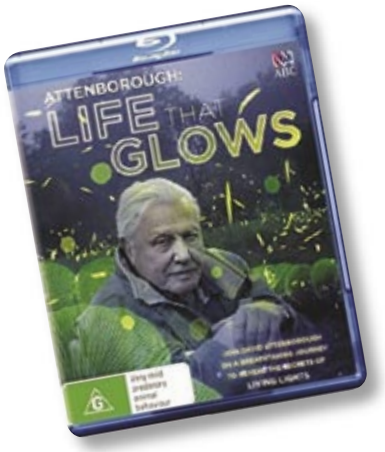


Figure 5 *- A concentration cell.*

Life that glows!

It has been about five years since we looked at the topic of bioluminescence [1] in this Bulletin. Since that time there have been some revisions to the documentation relating to both Higher Biology and Higher Human Biology qualifications [2, 3] but in both subjects one of the suggested learning activities continues to be 'Experiments on ATP dependent reactions, e.g. luciferase, luminescent reactions'.

Figure 2 *- Bioluminescent fungi (Image: https://www.scineon.com/mushroom/bioluminescent-mushroom-glows-in-dark-to-attract-insects).*



Bioluminescence is an area where significant advances continue to be made in terms of the ability to film examples of organisms which exhibit arguably the most enchanting and alluring properties. For those of you who have yet to see David Attenborough's 'Life that glows' which was broadcast in July 2016 then we cannot recommend it too highly.

Figure 3 *- Ostracod (image: http://www.microscopy-uk.org.uk/mag/smallimag/ostra.jpg).*

As yet the film does not appear to be available for purchase on DVD in a format suitable for UK players but it is available in Blu-Ray format and so if you have access to a machine which will play such discs than our advice is 'go for it!'

Life that glows gives details of the bioluminescent properties of a range of organisms covering both terrestrial and aquatic examples. Fireflies, as one might anticipate, feature prominently in the film but they are by no means the only stars of the show!

The life of bioluminescent fungi is explored in some detail and there is a short clip from the film available on the BBC website [3]. In his commentary David Attenborough points out that we do yet have 'all the answers'.

One of the most impressive bioluminescent organisms which is described is the humble ostracod, also known as the 'sea firefly', which 'pound for pound' probably gives the highest yield of bioluminescence. Despite its small size (a few mm in diameter (Figure 3)) when disturbed it gives rise to bright blue bioluminescence (Figure 4).

Figure 4 *- Bioluminescence from 'sea fireflies' (image: http://bluehorizonboutiqueresort.com/wp-content/uploads/2015/12/540b371e5fb229aa52effe65a045c6f7.jpg).*

The good thing is that dessicated sea fireflies are now available from Scientific and Chemical (product number $203431, 1 g quantities) - lots of fun to be had!

References

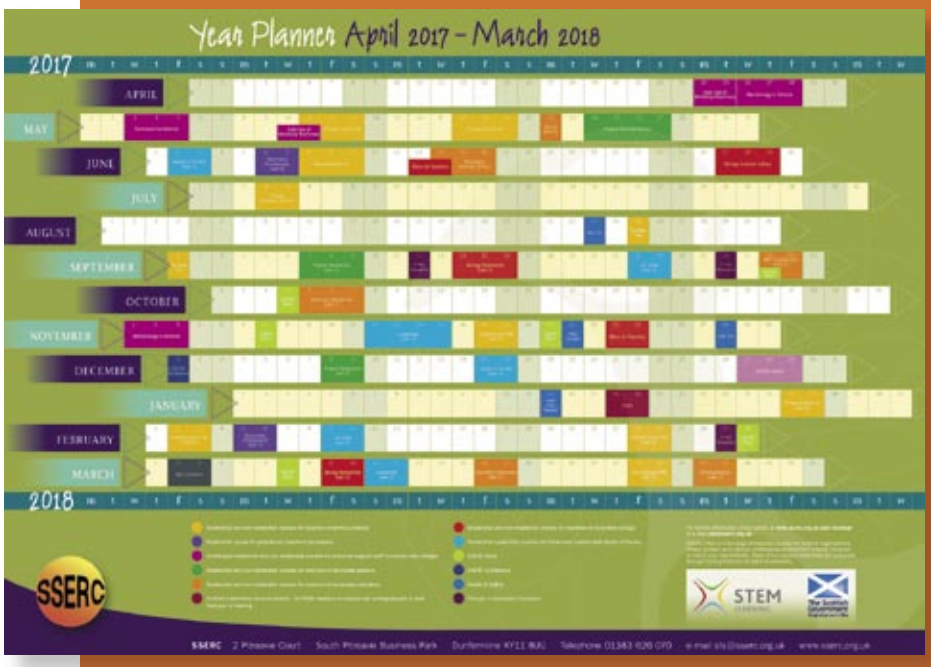
[1] SSERC (2012), Nature's Neons, SSERC Bulletin, **239**, 4-7.
[2] Course Unit Support Notes for both Higher Biology and Higher Human Biology can be downloaded at http://www.sqa.org.uk/files_ccc/CfE_CourseUnitSupportNotes_Higher_Sciences_Biology.pdf and http://www.sqa.org.uk/files_ccc/CfE_CourseUnitSupportNotes_Higher_Sciences_HumanBiology.pdf respectively (accessed 29th March 2017).
[3] A glowing underground network of fungi (2016), available at http://www.bbc.co.uk/programmes/p03syr6g (accessed 29th March 2017).

SSERC professional development courses

Our professional development courses range from twilight events, day-courses through to residential meetings lasting up to 6 days in total. Our curriculum coverage spans both primary and secondary sectors and we offer events for teachers as part of their career long professional learning, newly qualified teachers and technicians. Many of our events receive funding from the ENTHUSE awards scheme or the Scottish Government.

Courses available for online booking at this time include:

COURSE NAME	RESIDENTIAL?	DATES	CLOSING DATE	SECTOR
Science for Curriculum Leaders and Heads of Faculty	Yes	2-3 June 2017 and 15-16 December 2017	28 April 2017	Secondary
Chemistry Summer School	Yes	14-16 June 2017	08 May 2017	Secondary
Safe Use of Fixed Workshop Machinery	No	20-21 June 2017		Secondary
Biology Summer School	Yes	27-29 June 2017	26 May 2017	Secondary
Primary Summer School	Yes	4-5 July 2017	31 May 2017	Primary
Early Level Science Day	No	1 September 2017	9 June 2017	Primary

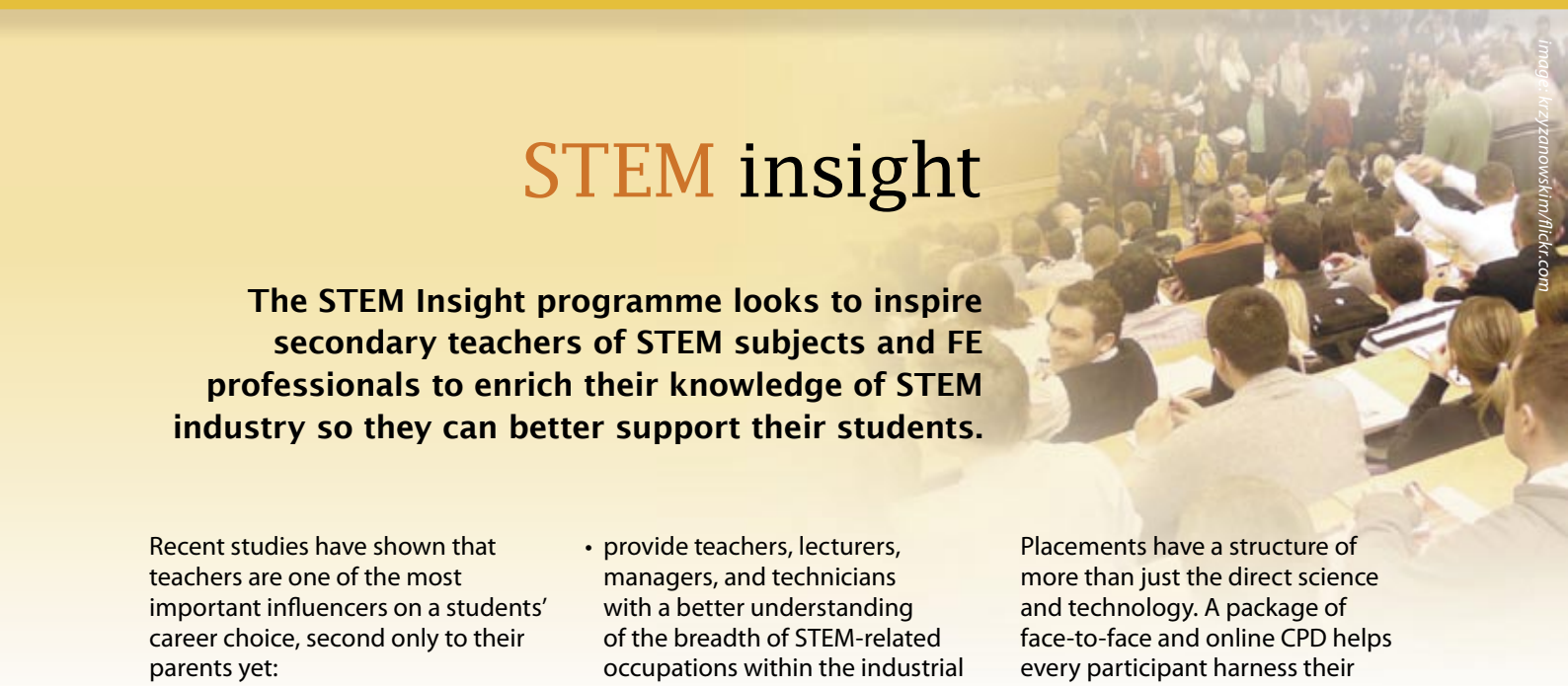


SSERC Year Planner

We have recently published our Year Planner for the period 1st April 2017 to the 31st March 2018.

Copies of the Year Planner have been sent to schools and colleges in SSERC membership. Additional copies can be requested through sts@sserc.org.uk.

STEM insight



The STEM Insight programme looks to inspire secondary teachers of STEM subjects and FE professionals to enrich their knowledge of STEM industry so they can better support their students.

Recent studies have shown that teachers are one of the most important influencers on a students' career choice, second only to their parents yet:

> *"82% of teachers think they are lacking the necessary knowledge to properly advise young people... one-fifth of parents admitted they believe they are out of their depth when it comes to talking to their offspring about career prospects."* ***(Association of Colleges, 2012)***

And...

> *"Nearly 53% of teachers do not feel confident giving advice about apprenticeships. In contrast, more than two-thirds said they were very or quite confident advising students about university study."* ***(EET/TES survey 2012)***

The STEM Insight into Industry aims to:

- give a unique chance to experience STEM work in modern industry and thereby enrich the teaching of STEM subjects;
- be an invaluable CPD opportunity which equips schools and colleges to respond to Developing the Young Workforce and transform careers guidance;
- provide teachers, lecturers, managers, and technicians with a better understanding of the breadth of STEM-related occupations within the industrial sectors of the UK, raising awareness of the career paths and progression routes through to industry;
- foster links between schools, colleges, and industry;
- build a community of practice, with a network of school/industry experts who can support other colleagues in schools and college.

The STEM Insight programme offers flexible approaches:

- Teacher-led: a teacher/school requests a placement near their school or college. The National STEM Learning Centre will aim to secure a local employer to match their requirements.
- Strengthening an existing school or college/employer partnership: offering access to the STEM Insight programme to further develop an existing partnership.
- Partner-led: an industry partner can offer placement(s) which are promoted through the National STEM Learning Centre website and our network of partners and ambassadors across the UK.

Placements have a structure of more than just the direct science and technology. A package of face-to-face and online CPD helps every participant harness their experiences once back in school or college.

Teachers and lecturers in Local Authority schools and colleges are eligible to receive financial support to cover the cost of participating in the programme from Project ENTHUSE. The fee for participating in the STEM Insight programme is £283+VAT, with a £1450 bursary for a ten-day placement and a £800 bursary for a five-day placement.

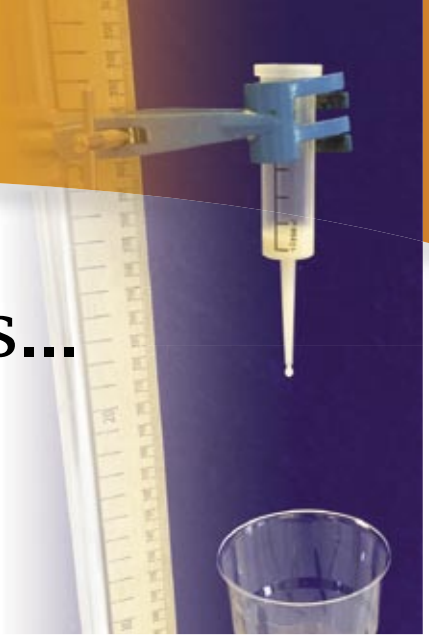
> *"Now that I'm back at work it all feels like it's clicked into place and I can relate my teaching to real life experience - something I wasn't able to do before taking part in the scheme."*
>
> ***Teacher participant (2014).***

Reference

Visit website: www.stem.org.uk/stem-insight or to speak to a member of the National STEM Learning Centre team contact insight@stem.org.uk.

PROJECT ENTHUSE STEM LEARNING

When every drop counts...



The Biology Team in SSERC has recently published a number of experimental ideas involving "immobilised" beads of enzymes, yeast, algae etc.

Figure 1 *- Preparing immobilised yeast.*

Classically, the immobilisation technique involves dropping a sodium alginate mixture from a syringe barrel into calcium chloride solution (see Figure 1). We have traditionally recommended a "Gilson syringe barrel" for this practical, but over the past couple of months we have received enquiries asking where these can be purchased and whether suitable alternative systems are available.

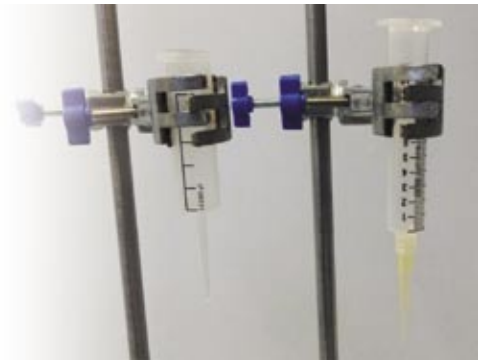


Figure 2 *- "Gilson" 12.5 ml syringe barrel (left) and a suggested alternative (right).*

The Gilson syringe barrels can be purchased from Fisher Scientific (catalogue code 12590316, £73.86 for a pack of 100) and Scientific and Chemical (code $F164120 £46.58 for a pack of 50). A non-branded but identical syringe barrel can be sourced at Griffin Education (catalogue code 10292261, £62.74 for a pack of 100).

We have tested alternative syringe systems and found that the following works well.

The alternative syringe apparatus (right hand side of Figure 2) consists of a 200 µl automatic pipette tip, which screws neatly into a Luer lock 10 cm^3 syringe barrel.

The 10 cm^3 Luer lock syringes can be sourced from Scientific and Chemical (catalogue code $BD300 912, £22.85 for a pack of 100). They can also be purchased from Griffin Education (catalogue code 12921031, £36.35 for a pack of 100). We used a 200 µl automatic pipette tip from Timstar (product code PI95032 (described as 5-200 µl yellow tips, pack of 1000 for £14.92). Most suppliers stock similar tips.

One distinct advantage of the suggested alternative is that the tips can be cut to any desired aperture to suit the viscosity of the alginate mixture and the desired diameter of alginate bead. Both versions work in all suggested SSERC practicals.

Borrowing equipment from SSERC

Between October and March, we often receive a high number of requests from schools wishing to borrow equipment for use in pupil investigations.

In order that we can meet as many requests as possible we generally set a loan period for a maximum of 4 weeks. In some cases, an extension for a further period may be possible but please contact us prior to the due return date to establish whether this is possible. We appreciate prompt return of the items as with some of the items a safety check is required before they can be loaned to another school. We ask that schools contact us before the return date so that we can agree the arrangements for the return particularly for those items which cannot be sent by mail.

Complying with Pressure Regulations in school science departments

School science departments are likely to own apparatus covered by the Pressure Systems Safety Regulations (PSSR).

Quoting HSE: "The aim of PSSR is to prevent serious injury from the hazard of stored energy (pressure) as a result of the failure of a pressure system or one of its component parts."

Devices covered by this legislation that may be used in schools include:

- Model steam engines (e.g. Mamod, Wilesco)
- Pressure cookers
- Autoclaves (see particular issues with thermostatically controlled autoclaves).

These must be safety checked annually against a Written Scheme of Examination (WSE). Any WSE has to be certified as suitable for your particular piece of equipment. There is a subtlety here. You may own a Mamod steam engine that is the same as a thousand other Mamod steam engines but the WSE for your engine has to be certified as being appropriate for your actual engine and not identical Mamod engines. Only a suitably experienced engineer can certify.

Non-thermostatically controlled equipment

For model steam engines, pressure cookers and autoclaves that are not thermostatically controlled, there are two routes you can go down. You can employ an outside company to examine your pressure systems. Alternatively, a competent person in your school or local authority can examine them, provided they have a certified written scheme of examination. Whilst many teachers and technicians in Scotland will be either capable of carrying out examinations or being able to do so after training, it is unlikely that there will be somebody local who can certify the WSE. If you are currently inspecting pressure systems in house, it is likely that you are using a scheme of examination that has not been certified. HSE will not accept this. Fortunately, there is a simple, cost-effective solution.

SSERC and our sister organisation CLEAPSS have been working with a company called LMP who have extensive experience in this field. LMP have come up with a protocol that does not necessitate an engineer visiting your premises. In order to receive a certified WSE, schools need to do the following:

- Take clear photographs of every piece of equipment that comes under PSSR. Even if you have six identical pressure cookers, photograph them all, making sure each has a unique identifier, for example a clearly visible code number or a coloured mark.
- Send the photos to LMP, clearly cross-referenced to a list of the equipment shown. The list should show the make, model and unique identifier.
- Include a statement that none of the equipment has been modified.

Provided that LMP is familiar with the equipment shown, you will be sent a WSE for each piece of apparatus. If you have three identical steam engines, you will still receive 3 WSEs, one for each. This is why it is important that identical items are in some way uniquely identifiable. You will need to have your WSEs recertified every 5 years. LMP has a robust database and can work with you to ensure you keep on top of this. Note that the purpose of the photographs is to enable LMP to certify that a WSE is suitable for your equipment. LMP are not using the photographs to judge the equipment or to examine it remotely.

LMP will invoice you for £10 per WSE issued. As these will be valid for a further 4 years, this is a very cost-effective solution.

Figure 1 *- Thermostatically controlled autoclave. Note the unique identifier (numeral 5) written on it.*

Thermostatically controlled autoclaves

Thermostatically controlled autoclaves such as the Prestige Medical (Figure 1) present another issue. The thermostat circuitry should ensure that the temperature is controlled so that pressure never rises to the level at which the safety valve operates. The safety valve can therefore only be checked by disconnecting the temperature regulating circuitry or by removing the valve and using calibrated test equipment. Neither of these can realistically be carried out by school or local authority staff.

This leaves you with the following options:

- Return your autoclave to the manufacturer for checking.

or

- Employ a company to test your device. Make sure that the check they carry out on the valve involves one of the methods above. It is not sufficient to simply check that its components move freely.

or

- Send your autoclave to LMP for testing and certification. This will cost £100 per unit.

or

- If you have more than 6 autoclaves or if your local authority can arrange for a number of autoclaves to be taken to a central location, it should prove cost-effective for you to contact LMP so that they can send an engineer out to test a batch.

We are, of course, happy to hear from other companies who could offer this service.

Contact details
LMP Technical Services, Rockleigh Court, 17 Rock Road, Finedon, Wellingborough, NN9 5EL, UK.
Telephone 01933 683810 or e-mail peter@lmp.co.uk, copying in Steve@lmp.co.uk.

Scotland, Singapore and SSERC

At first glance there might not appear to be a great deal of similarity between Scotland and Singapore. Closer inspection reveals some interesting areas of overlap. Both countries have an almost identical population size, are outward looking in nature, and have a passion for education. Scotland and Singapore are proud of their education systems, but both recognise that constant improvements are needed.

Part of SSERC's role is to offer curriculum support to teachers and technicians in the fields of science and technology. To maintain its position, SSERC must look to other education systems. In November 2016, Fred Young, SSERC CEO, visited The Ministry of Education (*MOE*) and The National Institute of Education (*NIE*) in Singapore to explore possible collaborative opportunities. Mr Young found a great willingness to share and began to explore opportunities for collaborative work. Students in Singapore recently achieved top rankings in the PISA (Programme for International Student Assessment) rankings which are organised by the Organisation for Economic Cooperation and Development to measure how effectively students use their knowledge and skills to solve real-world problems. Excellence in Science, Technology Engineering and Maths, (STEM), is currently a major focus for SSERC and so an exploration of the background to these Singaporean achievements could provide some very positive pointers. Both *MOE* and *NIE* where very keen to find out more about the ways in which SSERC supports

science and terchnology teachers and, if possible, allow their own Singaporean teachers and students to experience aspects of SSERC courses.

NIE hosted the first collaborative event with SSERC on 22nd March 2017 in Singapore. Professor Aik Ling Tan, Assistant Dean in charge of professional development at *NIE*, invited SSERC to run a session for her postgraduate science students prior to their first placement in

schools. The activities which were delivered were similar to those which SSERC uses during our annual Scottish Universities Science School (SUSS).

The Singaporean students engaged immediately in the activities and in their feedback comments such as, 'well done', 'Can we have more of such sessions?' were common. In particular, the students appreciated the topical nature of the activities and the way in which they were designed to ensure that all pupils would be actively engaged.

Plans are now being developed to invite *NIE* staff to present at SSERC events and to share their best practice. In time, it is hoped that it might be possible to organise a student teacher exchange between the two countries.

Health & Safety

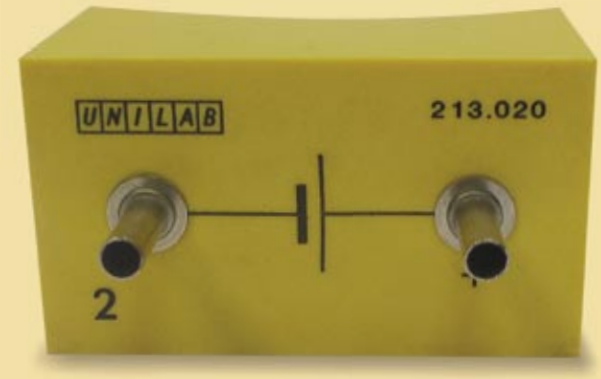
C. elegans - safety note

C. elegans is widely used as model organism for helminthic parasites. The most common human helminth infection in the UK is threadworms or pinworms (*Enterobius vermicularis*). *C. elegans* therefore is a useful model organism for project work as results can be related to a common infection. Working with *C. elegans* in the school laboratory is more likely to raise issues of sensitivity rather than ethics, although respect for all living things should be observed.

Levamisole acts as an acetylcholine receptor agonist leading to paralysis. Such cholinergic chemicals have largely been removed from sale (e.g. neurotoxic insecticides). Levamisole is not licensed for human use in the UK although it is available for use in agricultural livestock. Consequently we do not consider it suitable for use in schools.

Preparations containing Mebendazole (Ovex) are available for the treatment of threadworms without prescription from pharmacies. Mebendazole inhibits growth, reproductive capacity, and motility of *C. elegans*. A risk assessment based on the control measures in the patient information leaflet for Mebendazole suitably adapted for laboratory work should be suitable and sufficient to control any risk.

Battery safety



Pupils and students must, of course, never build circuits that run directly from mains electricity. Batteries make a safe, effective substitute, provided you follow some simple advice.

There are two significant hazards in using batteries in school:

- Swallowing a small battery;
- Severe overheating due to short circuiting.

Swallowing

This only concerns "button cell" batteries. The hazard here goes beyond choking or poisoning. There have been a significant number of cases when toddlers have swallowed button cells that have become lodged in the oesophagus. The mucus in that part of the body forms an electric circuit with the battery, creating a chemical that can cause severe internal burns. Whilst it is most likely to be younger children who put button batteries in their mouths, older ones might also do so to try to feel the tingle of a mild shock. In general, you will only rarely use button cells at secondary schools. Having said that, these batteries are used in some remote controls, novelty toys, small torches, musical birthday cards and so on. If you have visiting primary or nursery children, do not let them have access to devices where the button battery can be removed without undoing a screw.

Figure 1 *- The usual suspects – common sizes of battery. From left to right- D Cell, C Cell, AA, AAA, PP3 and button cell.*

Overheating due to short circuits

When children wire up circuits, some inevitably make mistakes.

Short circuits cause overheating in wires and within batteries. Batteries may become dangerously hot and even burst, releasing hazardous chemicals. The battery drains quickly, but that is the least of our worries. The severity of overheating depends on the current. This is governed by the internal resistance of the battery which is determined by the battery chemistry. Rechargeable batteries have low internal resistances whereas that of zinc carbon or zinc chloride batteries is relatively high. Alkaline and lithium batteries are somewhere between. This leads us to issue the following advice:

- Do not use rechargeable batteries for circuits that pupils build.
- The best batteries to use are zinc carbon or zinc chloride.
- The best sizes are D and C cells. This is not a safety recommendation. Rather it is based on the longevity of the battery.

Alkaline and lithium batteries are not so prone to dangerous overheating as rechargeables, but they are not as safe as zinc chloride or zinc carbon batteries. At SSERC we always say that if there is a safer way of doing something that is not ridiculously more expensive or inconvenient, do it the safer way. Most people know not to mix old and new batteries in the same device. Do not mix battery chemistries either.

This only applies to circuit building - it is perfectly OK to use rechargeables, lithium and alkaline batteries in cameras, calculators etc unless the manufacturer says not to. Use the correct charger for your batteries and be aware that some chargers are smarter than others. Basic chargers work on timers whereas smarter ones monitor battery voltage and/or temperature.

Buying batteries

Buy from a reputable source. It is not always easy to work out whether a battery is, say, zinc carbon rather than alkaline. Beware of batteries that are the same size as AAA or AAs but are higher voltage, for example the 14500 battery used in e-cigarettes. This can have a voltage of 3.7 V. If in doubt, contact SSERC.

Storing and disposing of batteries

If equipment is not to be used for some time, remove the batteries to prevent leakage. Do not open battery packs until you need the batteries. Be careful how you store loose batteries or batteries in holders. Could a piece of metal (or another battery) cause a short circuit? As you should not throw batteries out with normal rubbish, most schools will have a battery bin. There are collection points for used batteries in some shops and at civic amenity waste sites. If disposing of batteries, tape over the terminals before putting them in the battery bin. Examples are shown in Figure 2. Keep the bin out of reach of small children.

Figure 2 *- Taping batteries for safe disposal.*

Eyelash mite - safety note

Demodex is a genus of tiny (0.3–0.4 mm) commensal mite, two species of which live principally in or near the eyelash follicles and their associated sebaceous glands of humans. The presence of *Demodex* increases with age, with an incidence of less than 25% in those under 20 years to almost 100% in those over 70 years. Density is higher in patients with blepharitis, rosacea and acne vulgaris. Infestation is usually asymptomatic, although high levels of infestation may cause inflammation.

Demodex are photophobic and tend only to appear on the skin surface at night. The most common method of sampling *Demodex* is by eyelash hair epilation. Sampling may also be done by skin scrapings. Samples are viewed microscopically using HP (x40) objective.

Sampling *Demodex* in schools is not recommended. The size, density and location of mites make it difficult to ensure that a sample will contain mites. In addition students may find it difficult to locate individual mites under the microscope. Also individuals with skin conditions about which they may be sensitive are more likely to produce samples with mites. The inevitable public exposure may make them feel uncomfortable. Sampling mites by eyelash hair epilation must not be attempted in schools. Skin scrapings have been suggested using a glass microscope slide, long fingernail, side of a knife or spatula blade. None of these methods are recommended. It is a general rule that where samples are taken from human tissue, students must only work with their own samples. Such sampling methods should use sterile, single use disposable instruments (e.g. the ice cream spoons sold with small cartons of ice cream can be purchased in bulk relatively inexpensively and would suffice for a skin scrape). However the suggested method of obtaining a skin scrape sample suggests exerting a significant degree of force to express sebum. The exertion of a degree of force is not recommended.

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