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For those working in science or technology education

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Pupils and teachers re-united

No, this isn't about some new website where teachers and their former charges are encouraged to make contact after a number of years and reminisce about the good ol' days à la *Friends Reunited*. Nor is it about those disturbing reports such as:

"*Teachers have again become the target of web abuse after Scottish pupils used the internet to stalk up to 30 members of staff and incited others to join in the harassment.*"

What instead prompted this piece was a recent experience in having to call upon experts to solve a number of problems. As luck would 'ave it, these happened to be former-pupils of a school where I used to teach (the solvers, not the problems). Take my car for instance - please! Now, here's an interesting problem-solving exercise for anyone. It was 7.50 pm and the temperature gauge on the car was doing strange things. Was it the gauge itself, was the temperature sensor acting up, or was the cooling system on the car engine about to blow it's top? (Note the clichéd non-technicalities from the ex-science teacher. Well, it has been umm, . . . XX years).

On the off-chance, I called into a garage I've been using lately. There the major objective seems to be problem-solving and, refreshingly, not charging you until the problem is patently solved. The boss had gone home but there was one mechanic left. He was helping a taxi driver get his livelihood back on the road.

"*I'll be with you in 10 minutes*", the mechanic said cheerily. The face was familiar but I couldn't quite place it, as he sidled over at 8.05 pm.

"*Now, what's the problem? Eh! You used to be a teacher at . . . . . School*". (Name deleted to protect the innocent, or the guilty, depending).

After the smug satisfaction of coming across yet another former pupil with more grey hair (or less hair altogether!) than I had worn off, came recollection of the face. I explained the problem in a combination of scientific and layman's terms. He then got to work on a bit of problem-solving. He proceeded to ask various pertinent questions with which I'll not bore you. Next, he came up with this dinky little gun-type thingy (is that technical enough for you?). This had an impressive LCD display on the back and bore the legend "*Thermopile Infra-Red Thermometer*". Then, with the bonnet up, he aimed a wee laser beam at the hoses, the radiator - where the engine temperature sensor lives - and at other points in the cooling system.

"*Looks like there's no problem here*" he said encouragingly as all the temperatures came up normal.

"*Your gauge or more likely the temperature sender unit is likely to be at fault. We'll check it out electrically at your next service*".

It was 8.30 pm (he was supposed to finish at eight) by the time we had discussed the intricacies of modern fuel-injection systems and bandied about words like hydrocarbons, feedback loops and air-flow detectors.

It was humbling and satisfying to see someone, who was just another wee laddie back then, now making his way in the world, using a scientific approach to solve problems, employing the latest technology and doing it in a manner which encourages confidence and customer satisfaction.

You can keep all your exams and psychometric testing. Instead treat weans properly, give them some respect and don't over-burden them with excessive analysis or assessment. As a result, just maybe, they'll repay you some day. Then you too may feel that there is, after all, a future for teaching, for science education and for humankind.

Postscript:

Other expert former-pupils who have come to the rescue recently included a doctor, plumber, an auto-electrician (yes another one, that's modern cars for you!) No butchers, bakers or candle-stick makers though - yet.

Ian J. Birrell

Acting Director

Fred Young has been appointed by the SSERC Board as Acting Executive Director for the duration of John Richardson's secondment to the ISE 5-14 project.

ISES News

The Institute for Science Education Scotland (ISES) has circulated its second ISES *Bulletin* publicising CPD and other events planned for the period August to October 2003. This bulletin has been produced in response to a need identified in a number of the consultative meetings held across Scotland and led by Dr Susan Rodrigues, ISES Director. The bulletin has been copied to members of the Scottish Science Advisory Group. It is also posted on the "Events" section of the SSERC members' website.

New chemistry project

Don Sutherland, Principal Teacher of Chemistry at Deans Community High School, Livingston has recently been appointed, as a part-time Development Officer, to support a project aimed at updating school chemistry. This project is entitled *Development for Updating School Chemistry (DUSC)*. Further detail is given in "Chemistry News" on page 13.

Summer schools

Each of the Science Summer Schools went well this year and currently it looks likely that all will run again in 2004. One new venture was a three day Biology Summer School for PGCE students run shortly before they left their respective Initial Teacher Education Institutes (ITEIs). This was organised through the Scottish Institute for Biotechnology Education (SIBE) and hosted by Strathclyde University with much assistance from Dr Ian Hunter who's based there. The burden of organisation for the Edinburgh Chemistry School should be eased with the recent appointment of a part-time Development Officer for the *DUSC* project (see above).

SAPS 5-14 resources

The SAPS Scotland Biotechnology Education Project has agreed to the part-time return to SSERC of Kath Crawford one of its Development Officers. Kath is now dividing her time between SAPS work programmes and the Improving Science Education 5-14 CPD through Practical Activities Project.

This arrangement has already borne fruit in the shape of a practical workshop on the new microbiology and biotechnology elements in 5-14 science at levels E and F. These materials have been trialled and were well received not only by biology specialists but also by colleagues with a chemistry or physics background. They will now be redrafted and enhanced over the Summer break.

Members of the SAPS Scotland Biotechnology Education Project have also been working on other topics relevant to 5-14. Marjorie Smith, Pamela Ferguson and colleagues at Dollar Academy have been developing and trialling relevant practical materials in a project sponsored by Astra Zeneca with advice and guidance from the National Asthma Foundation.

This work has resulted in the production of suggestions for investigations with a cross curricular flavour, in a novel format. The resource is aimed at levels C and D here in Scotland as well as the relevant Key Stage elsewhere in the UK. It is entitled *Applying your Science : Lungs, Pollen, Allergies and Asthma*. It consists of a pack of spiral bound cards in a form which will stand unsupported in the middle of a work table. This format was chosen in response to primary teachers' complaints that packs of workcards in conventional form simply take up too much space when a group of children are doing practical work requiring lots of other bits and pieces.

A pocket accommodates a CD ROM with all the files for the investigations plus teacher's notes etc. An initial run of 1,000 copies has been produced for the UK as a whole. About 450 copies will be available here in Scotland for use in workshops etc. As an incentive for secondary specialists to support the implementation of the materials, the CD also has some material targetted at Higher and Advanced Higher. This is a Powerpoint presentation on the very up to date topic of pharmacogenetics (as alluded to in phrases such as "tailored medicines").

ISE 5-14 progress report

SSERC is currently engaged on two elements of the Improving Science Education 5-14 Programme. These are the ISE 5-14 website and the CPD through practical activities project. Progress on building the new website founded on the old SOLSN site can be checked simply by logging on to : www.ise5-14.org.uk.

The CPD elements on the other hand are being facilitated, rather than directly managed, by us. We've been trying to build capacity for quality CPD based on the SAPS and SSERC workshop models. This we're trying to do by encouraging the setting up of collaborative partnerships involving local authorities, science centres, professional institutes, higher education and the research institutes.

None of this, as you might imagine, has proved simple or easy to achieve. Recently, however, we've had what we trust will be our first significant breakthrough when we signed an agreement with the South East Earth and Space (SEES) Consortium for the development and delivery of practical training to national and local trainers on learning and teaching for earth and space topics within science 5-14. The lead partners in the SEES consortium include Dynamic Earth, the Royal Observatory Trust, the Scottish Earth Science Education Forum and Moray House Institute. The Local Authorities involved with SEES include East Lothian, Midlothian, West Lothian and Scottish Borders.

Negotiations are still ongoing with other potential consortia and one other agreement on funding is close to completion.

Part of SAPS moves

Another consequence of Kath Crawford's part-time return to work within SSERC has been the physical relocation of the SAPS Scotland Edinburgh office. This is no longer located within the Institute of Cellular and Molecular Biology at Edinburgh University but has moved meantime alongside SSERC here in the St Mary's Building in Holyrood Road. That branch of SAPS Scotland thus has a new address and 'phone number - see list on back page.

Congratulations!

We've made it plain, to the point of nausea, in these columns that we hold no brief for the defence of the education inspectorate. Exceptions, however, aye prove the rule. Dr Jack Jackson HMIE is surely one such. His consistently supportive approach to schools, teachers and pupils deserves commendation. His recent promotion to Assistant Chief Inspector is thus doubly welcome. Not only it is well deserved, but it may herald a change for the better in some inspectorial attitudes and approaches. (Fingers crossed that this note won't prove a kiss of death).

Chemicals list added to ASE web-site

The Safeguards in Science Committee of the Association for Science Education (ASE) has recently updated its previously published list of Restricted Chemicals. It has placed this new list on the members' section of the ASE web-site (ase.org.uk) under the section titled "Resources". The purpose of the list is to alert teachers and technicians to the hazards of certain chemicals, to recommended methods of their use and to suggest measures to control risks. The new list is more extensive than its predecessors (it runs to 47 pages) and users should find it both useable and useful.

The list is alphabetical and in tabular form. Where it is likely to be relevant, the hazards of diluted solutions are also given. For most chemicals on the list the risk phrases used, which are a shorthand way of denoting the hazards, are taken from the 7th edition of the Approved Supply List published under the Chemical Hazard Information and Packaging for Supply or CHIP Regulations 2002.

The current format is pdf and can be printed on A4, but later versions will be in searchable form. Having the list on the web means it can be updated easily to take account of any changes in the categories of hazard (strangely called risk phrases by the HSE!) in the Approved Supply List.

The information is necessarily brief and other more detailed sources such as our own Hazardous Chemicals Manual, Interactive CD2 (SSERC 2001) or Hazcards (CLEAPSS 1995, as updated 2000) should also be consulted.

The list of restricted chemicals originated as a table in Topics in Safety (ASE), in 1982, and was updated in the second edition in 1998. This later list was the basis of a table entitled "Specific Chemicals" in Safety in Science Education (HMSO), 1996.

In producing this current list on the ASE web-site, the table has been further expanded, both in the range of chemicals listed and in the detail of their hazards and recommendations for use. The nomenclature used for chemicals is that in Signs, Symbols and Systematics (ASE 2000).

Bacterial transformation kit

We've had a number of enquiries recently on the instructions which come with the Bio-Rad pGlo Transformation Kit which utilises the gene for fluorescent green protein from the jellyfish *Aequorea victoria* (now also of *Incredible Hulk* fame). These instructions were written for the North American market. Teachers and technicians, quite rightly, have pointed out that in several respects they do not conform to the current safety guidelines on the use of micro-organisms in Scottish schools and for non-advanced work.

The SAPS Biotechnology Scotland Project Team regularly run workshops using the Bio-Rad kit. They recognised early on that the original Bio-Rad instructions had to be revised to meet UK regulatory requirements.

They have prepared their own Teacher and Technician Guide. We suggest that Scottish schools use that SAPS Guide instead of the original Bio-Rad protocols. Particular points worth stressing are as follows:

1 Aseptic Technique must be followed throughout, i.e. in preparation of materials for classes, by students carrying out the practical work and in disposal.

2 Preparation for work and all microbiological techniques used should follow the methods described either in the Microbiology Techniques Cards issued by The Higher Still Development Unit as part of the Higher Still programme or in the updated SSERC/SAPS versions on CD ROM..

3 Media should be sterilised by autoclaving*.

4 Cultures should not usually be incubated at 37°C. (The protocol works even when the *E.coli* are incubated at 30°C it just takes a bit longer).

5 The transformed bacteria produced in this experiment are exempt from the '*Contained Use*' Regulations but they are still subject to the *Genetically Modified Organisms (Deliberate Release) Regulations* 1992 (as amended 1995, 1997 and 1998). Although *E. coli* K12 used in this kit is a debilitated (weakened) strain and unlikely to survive outside the laboratory, it is essential to make sure that the organisms are not released into the environment.

6 All transformed cultures must be disposed of by autoclaving (or treatment in a pressure cooker) at a temperature of 121°C for 15 minutes*. This needs to be done within seven days of inoculation after which autoclaving, the cultures can be disposed of within an opaque bag placed in normal refuse.

* Not by immersing in disinfectant as suggested in many resources from the USA.

Accident Report

Open evening accident

A recent CLEAPSS[1] Bulletin note gave a brief initial report of an accident at an open evening for parents. The incident involved the very vigorous reaction between magnesium powder and silver nitrate. This is initiated by adding a drop of water, to a mixture of the two. This was being demonstrated in a fume cupboard. It appears that for convenience the two reagents had been pre-mixed and stored in a jar, with dollops of the mixture being removed to another receptacle for demonstrating to each small group of parents and pupils. In the course of events somehow a few drops of water fell into the jar of mixed reagents which then exploded.

Unfortunately, a technician was working at the fume cupboard at the time. She received serious burns to her right hand and other injuries. We understand there were less serious injuries to a pupil and some collateral damage. We shall report more fully in due course once the full facts have been investigated and reported.

Electrical isolation and cut-off

Electrical services to practical work areas including technical workshops and science labs should be fitted with localized switching for isolation and emergency cut-off.

Introduction

The scope of this report covers two types of manual controls (isolation and emergency cut-off) that should be readily accessible in work areas for switching off the electricity supply.

These are additional to other essential switches, some automatic, others manual, namely a manual isolator and fuse or MCB in the distribution board, an RCD, and functional switches at socket outlets and on apparatus (Table 1). Because of the huge school rebuilding programmes now underway, SSERC has been asked by councils for guidance on whether science labs should be provided with emergency switching.

Switch	Location	Actuation	Purpose
Isolator	Distribution box	Manual	To allow maintenance
MCB or fuse	Distribution box	Automatic	Prevents damage by overload, or short circuit
RCD	Distribution box	Automatic	Protects by detecting an earth leakage fault to remove danger
Localised isolator with keyswitch	Classroom near entrance	Manual	Prevents socket outlets being energised, so as to remove danger
Emergency cut-off	Classroom, prominent position	Manual	De-energizes a live socket to remove danger
Functional switch	Socket outlet	Manual	Operates load
Functional switch	Apparatus or machine	Manual	Operates load

Table 1 Switches for isolating or cutting off the electricity supply. (Additional localized isolators and emergency switches are required for certain fixed workshop machines.)

The need for emergency switching in technical workshops would seem to be widely accepted [1, 2]. Before explaining why this switching is needed in science labs also, let us first explain the different functions of the two types of switching, one for isolation and the other for emergency cut-off.

The purpose of an isolator is to cut-off the electricity supply before certain activities take place. Generally this is to allow maintenance to be done safely. Additionally, in school practical areas, this should ensure that electrical apparatus or machines cannot be energized when, for instance, students are not being supervised, or to ensure that the electricity supply is dead for certain dangerous practices such as learning to wire a plug. Quite differently, the purpose of an emergency cut-off is to switch off the electricity supply in a hurry once danger is present. This allows machinery or apparatus to be de-energized, or to deaden the supply when someone gets a shock, or is at danger of being shocked. The Architects and Buildings Division of the DfEE (now DfES) in England publish a series of technical documents that are highly influential throughout the UK in the design of school buildings and the provision of facilities and services therein. They [1], with a supporting British Standard [2], both clearly recommend that emergency switching systems should be provided for school technology work areas. However regarding science labs, the Architects and Buildings Division seem mealy mouthed [3]. On account of this, many existing science labs do not have emergency switching systems and from enquiries to SSERC it looks as though some new installations may not be getting them either.

There is however a new British Standard [4] that clearly recognizes the need for switching in laboratories. This new standard is not specifically tied to school laboratories, but "(its) recommendations may be used by all parties involved in the design, manufacture, installation and use of a new laboratory or in the refitting of an old laboratory".

Risk assessment

The general point is that no one planning a laboratory installation can ever be entirely sure what activities might take place. They are general purpose rooms for practical activities. Because of the human element, there is scope for unforeseen activities with electrical systems, not only those set up by teachers or technicians, but also practices contrived by students, whether through ignorance, childish mischief or simple wrongdoing. Added to the human element for surprise, there is much electrical apparatus in use, some of which probably will be both aged and sub-standard, and therefore at risk of being faulty.

Table 2 (opposite) lists some activities that present a risk to health and safety and where the risk can be removed by either isolation or an emergency cut-off action.

Summary recommendations

We have identified a range of hazardous activities and practices that could result in a person, probably a child or adolescent, being at risk of harm from an electric shock from the mains supply in a school laboratory.

Hazardous activity	Comment	Protection
Students wiring a plug	There is an accident history of plugs that have just been wired by students being inserted into live socket outlets.	Isolation of the supply for the duration of the activity
Mechanical injury from a high speed rotary machine	Apparatus includes centrifuges, fractional HP motor, etc. Risk of catastrophic failure, ejection of parts, entrapment, etc.	Emergency cut-off
Electric shock from apparatus in a dangerous condition	There is a low frequency accident history of teachers and students experiencing shocks from faulty apparatus.	Emergency cut-off
Dangerous activities by children or adolescents, whether accidental, or deliberate, or the result of curiosity	Dangerous activities include: - *Probing the interior of enclosures* - *Inserting foreign objects into enclosures* - *Inserting paper clips, etc., into socket outlets* - *Cutting mains cords* - *Rewiring plugs etc with the wrong polarity* - *Opening an enclosure to effect a repair* - *Melting insulation with the hot tip of a soldering iron* - *Tampering with apparatus*	Emergency cut-off
Electric shock caused by apparatus or electrical systems accidentally getting wet	The following incidents are foreseeable: - *Handling apparatus with wet hands* - *Setting up apparatus on a wet workbench* - *Spraying apparatus with water or other conducting fluid*	Emergency cut-off
Activities with general hazards deriving from administrative procedures in schools	Hazardous activities include: - *Students energizing apparatus when unsupervised because the teacher is not in the laboratory* - *Non-science classes being taught in a science laboratory by non-science subject specialists*	Isolation of the supply whenever students are not being directly supervised by a specialist science teacher

Table 2 Some electrical hazards in school science laboratories.

Means of isolation and protection should be provided in accordance with appropriate IEC standards. Emergency tripping facilities should be provided by means of a single stop push button to control all bench outlets from one position within the laboratory near the teacher's bench and main room exit. All bench outlets and certain fixed equipment should be protected. There should be additional protection through MCB and RCD devices.

Critical circuits specifically installed to remove hazards (e.g. fume extractor fans, lighting, alarm circuits) should not be controlled by the emergency system unless powered from socket outlets in which case the emergency cut-off should have overriding control.

References

1. "All fixed equipment should be permanently wired to the electrical distribution system and be controlled by an isolating switch located either on the equipment or within 2 metres of, and accessible to, the operator. For certain machines the switch must be lockable. Most machines also require individual emergency stop buttons, controllable via knee or foot." Section 6.2.

   "Each work area containing fixed electrical equipment should have a lockable single switch disconnector and an emergency stop system. These should control all the electrical power circuits except those serving equipment which is designed to remove a hazard (such as a fume cupboard)….." Section 6.3.

   Building Bulletin 81: *Design and Technology Accommodation in Secondary Schools*: Architects and Buildings Division, DfEE.

2. "Emergency switching systems should be provided in each separate work area. The systems should switch off all circuits supplied via the switch-disconnector in an emergency. Critical circuits specifically installed to remove hazards (e.g. fume extractor fans, lighting, alarm circuits) should not be controlled by the emergency system."

   BS 4163:2000 *Health and safety for design and technology in schools and similar establishments – Code of practice*: Section 5.2.5 *Work area emergency switching systems.*

3. "A central push button isolator is also useful and should be positioned near the main laboratory entrance, easily accessible to the teacher."

   Building Bulletin 80: *Science Accommodation in Secondary Schools*: Architects and Buildings Division, DfEE: Section 5.8.

Never mind the gas, get a microwave

Chemists use microwave heating to speed up reactions, boost yields and make 'awkward' reactions proceed. An educational application of such techniques is described and evaluated.

For some time now, microwave ovens have been used in the home for cooking and re-heating food. In fact, the use of microwave ovens, for this purpose, has increased dramatically since their introduction. From this increase in use, we can, perhaps, conclude that using microwaves to cook or re-heat food doesn't necessarily do anything unusual or unacceptable to it! Chemists have also found the same to be true for making chemicals. Indeed, over the past twenty years or so, commercial, research and industrial chemists have discovered that, by using microwaves, they can speed up reactions, boost yields and make 'awkward' reactions proceed.

So, how do microwaves work?

In this context, the essential point is that microwaves cause polar molecules like water to spin. As they spin, they knock into other molecules causing them to vibrate. The effect of this vibration is that the molecules heat up. This method of heating results in solutions being almost uniformly heated, which is much more efficient than traditional methods where the heat is transferred slowly by convection from the container to the core of the reaction mixture. In fact, in microwave heating, the core of the reaction mixture is hotter than the outside due to surface cooling. The effect of all of this is that reactions generally go faster in a microwave.
A more detailed description of the process by which microwaves heat substances is given in two excellent articles in *Education in Chemistry* [1,2].

Can they be used in school labs?

We've been trialling these techniques. This was to check for ourselves that domestic microwave ovens can be used successfully in the school laboratory as an alternative to the more conventional means of heating. We adapted a well-worn method for the preparation of Aspirin. This we took from the *Advanced Higher Chemistry, Prescribed Practical Activities (Unit 3, PPA 4).*

Figure 1 *Inexpensive, digital display microwave oven*

This published procedure was then adapted to use an 800 W category E microwave oven. The type of oven used was a digital display model, with a rotating turntable, purchased for £45 from Argos (Figure 1). We chose this digital display model as it gave more control over timings (i.e. possible to select seconds).

Preparation of aspirin

The microwave based procedure runs as follows:

1 Weigh out 5 g of 2-hydroxybenzoic acid into a 250 cm^3 beaker. Break up lumps.

2 Add 10 cm^3 ethanoic anhydride and 5 drops 85% orthophosphoric acid.

3 Swirl contents to ensure all 2-hydroxybenzoic acid is wetted by the anhydride.

4 Cover with a petri dish.

5 Place in a microwave alongside an uncovered 400 cm^3 beaker containing 200 cm^3 water. This absorbs excess microwave energy. The water may become superheated. Allow to cool before attempting to move it. Wear goggles and handle with care as it can 'spurt'.

6 Heat for 60 s. Swirl to mix and check the temperature. It should be between 120-130°C.

7 If the temperature is low heat the mixture for a further 30 s. Swirl and check the temperature.

8 Repeat above two steps until the required temperature is reached. Note temperatures above 130°C may generate by-products and reduce the yield of aspirin.

9 Remove beaker from microwave. Take care it will be very hot.

10 Allow it to cool to between 95-100°C before pouring it into 150 cm^3 cold water.

11 The mixture will oil out and should be stirred until the solid starts separating out.

12 Cool in an ice/water bath.

13 Filter using a Buchner funnel, filter flask and water pump then wash it thoroughly with several portions of cold water.

14 If necessary the aspirin may be recrystallised from hot ethanol as per sections 7-13 of PPA 4.

Clearly, this method differs from that described originally in the Unit 3, PPA 4. The differences are sufficient to require a revisiting of the risk assessment (see next column).

Additional Control Measures

In addition to those measures listed in the original prescribed practical activity (PPA) take the following precautions:

- Use heat resistant gloves when removing the beakers from the microwave.
- Site the microwave in a fume cupboard or use it only in a very well ventilated room.

Conclusions

So, did we find any advantages or disadvantages to using a microwave oven? Well, on the plus side, the reaction time for the microwave method was considerably shorter than for the traditional method and yields were comparable. In addition, when using the microwave method there is no need to stir, which reduces the chances of spillage and burns.

On the negative side, we found the microwave very efficient at spreading vapours from the reaction around the laboratory.

Overall, on the basis of this trial, we feel that a microwave in the science department could be a useful additional tool for some kinds of project work and for demonstrations. We're not so readily convinced about some of the applications being touted for microbiology. It is our intention to explore further the use of microwaves in the school science laboratory over the next few months so - watch this space!

References

1. D. Brady, *Put it in the microwave*, Education in Chemistry, volume 39, number 5, September 2002, Royal Society of Chemistry.
2. A. G. Whittaker, *Microwave Chemistry*, Education in Chemistry, volume 39, number 5, September 2002, Royal Society of Chemistry.

Enzyme mediated synthesis

A trialled protocol, showing the action of phosphorylase (from potato) on glucose-1-phosphate, is described.

Since its re-inclusion in some curricular materials, we have had a number of enquiries seeking a reliable procedure for this practical. It is a procedure which shows that starch is formed by the polymerisation of glucose in an enzyme mediated reaction,.

We had, until recently, regarded this practical simply as a weel kent procedure from *Nuffield Biology* and *Biology by Enquiry.* Perhaps that only shows how auld some of us are now getting. Nonetheless we went back to the bench to retrial and possibly refine the earlier publshed protocols. The results of that effort are presented here. At school level, nearly all of the enzyme based practicals involve the breakdown of a substrate into simpler components. This procedure is thus particularly useful, showing that enzymes are also needed to build up big, possibly complex, molecules from smaller, simpler, ones.

Extracting the enzyme

Liquidise about 100 g of potato tissue in 200cm^3 of distilled water and filter the resultant mass through muslin. Then centrifuge the filtrate, testing at intervals with iodine in potassium iodide solution, until the supernatant is starch-free. Use this as your 'stock' or primary source of phosphorylase.

Demonstrating the enzyme's action

1. Using a spotting tile add 2 drops of the starch-free potato extract and 2 drops of glucose-1-phosphate to the top row of wells and mix gently.
2. Add 2 drops of iodine solution to the first well of the tile and gently rock to mix the liquids. The liquid was examined the colour noted and left for 10 minutes.
3. Repeat this addition sequence 10 times in each of the four wells.
4. Set up a control row using glucose-1-phophate (no potato extract i.e. no enzyme) plus iodine in KI solution.
5. Set a second control row with enzyme (potato extract) and iodine in KI solution (i.e. no substrate).

Tips and technical details

Recipes:

Use 0.1 M iodine in potassium iodide as the stock solution to dilute in order to test for starch formation. To make up one litre of stock solution:

Use 40 g potassium iodide (KI) and 25.38 g of iodine (I_2) to one litre of distilled or deionised water. Firstly, dissolve the KI in two thirds quantity of water add I_2, stir and dilute to final volume. Dilute this stock 'iodine' reagent again, 1:20 v:v with deionised or distilled water, before use .

Use the glucose-1-phosphate as a 1% w:v solution in distilled or deionised water.

Other points:

Note that the activity of potato phosphorylase may well vary both with the variety of potato used and with the time of year. Such variation in activity may partly reflect for how long the tubers may have been stored and under what conditions. Note also that the starch to sugars ratio in tissues under cold storage, may be a frost protection system for many plants. This could provide a suitable topic for investigation.

Further detail

Lack of space here precludes illustration of the procedure with photographs etc. A fully illustrated version of this protocol is to be found within the web page edition of Bulletin 209 on our members' website.

Come fly with me - getting the drop on *Drosophila*

Some updated tips are provided on the husbandry of the fruit fly Drosophila. *Advice is given on suitable anaesthetics, the handling of live flies and on appropriate, acceptable, techniques for euthanasia.*

With the demise of several older biological supply houses in the UK, it has become increasingly difficult to source some key living materials for learning and teaching. Latterly, this has even extended to well established lines and kits used previously to teach simple genetics. This recent withdrawal of materials has included popular kits containing tomato seeds. These had been used extensively in schools to demonstrate simple Mendelian crosses. This has led some Scottish schools to turn again to the more onerous business of maintaining and using the fruit fly *Drosophila.* We've fielded a number of enquiries on this topic of late. We still intend continuing the search for other, less time-consuming, plant-based alternatives but, meantime, we judged it might be helpful, especially to newer entrants whether teachers or technicians, if we summarised the key points in a short article.

Medium for 'culturing'

This is the recipe which seems currently to be most used for maintaining colonies of *Drosophila*. The quantities given in the table are per litre of deionised or distilled water.

Ingredient	Amount (g)
Agar	10
Sugar (sucrose)	50
Cornflour	25
Maize meal	10
Dried yeast*	pinch per container
Porridge oats*	as above

Table 1 *Drosophila medium recipe. Ingredients marked * are added to each of the culture containers.*

Prepare a set of universal containers or vials. Sprinkle a small amount (a 'pinch') of dried yeast granules, and a similar amount of porridge oats, into the bottom of each of the bottles. Add the other ingredients to the cold water. Bring them up to the boil and stir until the whole is consolidated in solution and suspension. Remove the heat and allow to cool. When the medium is sufficiently cooled, dispense 10 cm^3 aliquots into the vials or universal containers.

Suppliers

Agar - for details of suggested suppliers see the address list on the back page. All the other ingredients can be bought in bulk, so go directly to a wholesaler (we used the Edinburgh wholesaler *Ryan Wholefoods* but there will be similar firms in other localities). The ingredients can also be bought in supermarkets and retail wholefood shops. You need to be aware, however, that some foodstuffs may have been treated with insecticide and so contain traces as contaminants. Obviously, this will not make for healthy colonies of flies.

Ready-mixed dried medium (fast-foods for flies, whatever next?) is also available and can be purchased from *Blades Biological*.

Handling

After you've purchased your flies, got the colonies established and set up various crosses comes the first, and only really, tricky bit. How to count the results of crosses to establish ratios etc without flies heading off for the nearest fruit shop? The answer is to use some kind of anaesthetic. At one time the favoured substance for this role was ethoxyethane (diethyl ether). This application has been the subject of worries over the extremely flammable nature of this material. Also there are concerns about the formation of potentially explosive peroxides in prolonged storage. As a result, many schools have abandoned the use of ether as an anaesthetic. Some have substituted for ether by cooling the flies, often using dry ice for the purpose. This has not proved entirely satisfactory and more recently suppliers have been offering proprietary solutions (no pun intended) to the problem.

Fly-Nap

Fly-Nap is one such proprietary product. It is very effective and allows between 50 minutes to 2 hours for examination of the flies. This time span depends on the amount of Flynap on the *wand* used for its application. It depends also on the number and age of the flies subjected to the given dose (again, no pun . . Oh, what the h..l!).

Figure 1 FlyNap kit and packaging showing bottle of anaesthetic, 'wands,' anaesthetising chamber etc.

In our trials, the flies were still anaesthetised after 2 hours but all had come round by the next morning. On average, just less than 90% of the flies exposed survived their exposure to a normal dose of FlyNap.

So, what is in this anaesthetic? Well, it contains 50% triethylamine (HIGHLY FLAMMABLE;CORROSIVE;HARMFUL to the eyes, in contact with the skin and if swallowed), 25% ethanol (HIGHLY FLAMMABLE) and 25% 'fragrance' (to mask the smell of the triethylamine!). This all sounds pretty horrendous but we are confident that *FlyNap* can be used safely. The major factor controlling risks to their health is that students will be exposed only to very small amounts. Nonetheless good ventilation is essential.

FlyNap does, however, have a distinctive odour. "Distinctive" is being very kind to it. Gauging the 'offence rating' of an aroma will always be a highly subjective business. We found it decidedly unpleasant. Even a trace left on the fingers (easy to do when handling the wands) leaves a lingering smell that does not readily wash off. So we would certainly recommend wearing gloves even if they have be removed afterwards for the trickier bits of the procedure such as actually sorting the results of crosses etc .

Another problem arises when a wand is inserted into a culture tube: it is easy to contaminate the stopper with the anaesthetic, so flies may continue to receive an unnecessary, and unwanted, extra dose of Fly Nap.

FlyNap is sold by two UK based suppliers. *Blades Biological* FlyNap for example is £13.97 plus postage and packing with *Philip Harris* asking £18.37 inclusive for theirs.

Once the work is completed, flies should either be properly maintained for future work or disposed of humanely. Such surplus flies can be autoclaved or placed in the freezer, either of which will despatch them quickly and cleanly. Alternatively there is a little container supplied with the FlyNap Kit and this can be filled with alcohol or mineral oil and used for disposal purposes.

Verdict on *FlyNap*

We found this kit to be clean, convenient and easy to use. It proved more reliable and consistent in use than the old ethoxyethane, filter funnel and cotton wool set-ups. It also allowed plenty of time to sort and examine the flies.

Escapees

It may be useful to use a trap to catch any fruit flies which escape into the area. A jar with a rolled up piece of paper or filter paper placed in the neck of the jar baited with some cider vinegar or a piece of banana will attract any flies with Steve McQueen-like ambitions.

Acknowledgement: Some of the tips given here were based partly on advice previously published by our sister organisation CLEAPSS.

Figure 2 *Simple DIY fly trap with paper or card funnel soaked in an attractant such as cider vinegar or with a piece of banana in the base.*

Dormant Protist Kit

A brief review of a kit from the supplier Sciento which simplifies the culturing of protozoa in schools

This kit from *Sciento* (see address list, rear cover), catalogue reference PK5, costs £13.85 plus postage. The kit relies on an intriguing survival tactic of many protozoans - their ability to encyst and, often, to wait out droughts or other unfavourable conditions. The kit contains harvested cysts which have been dried out but which can be reconstituted, as and when they are required for teaching purposes. We bought such a kit and report here on our trialling of it.

Review

The leaflet supplied by Sciento with this kit is excellent. It provides good instructions and the steps required for successful reconstitution and subsequent maintenance are both well explained and nicely illustrated. Three days after setting up our first cultures, simple microscopic examination gave reasonable results but from day five until day ten produced much more activity.

Care had to be taken to close the lid of the container and shake its contents before removing a droplet of water from the bottom of the container and placing it on the slide for examination. This is an excellent opportunity to exploit the 'hanging drop' techniques, using film container lids, as (re)popularised by SAPS [1]. It may also provide a useful application for some of those Intel video microscopes supplied through the *Science Year* initiative.

Examination of hanging drop preparations of culture samples after six weeks was also found to be rewarding. Cultures had remained active with many of the species described in the booklet being seen with relative ease. We first tried out our kit in the late Winter. Another culture was set up at the end of March this year and first examined about four days later. There seemed to be more activity at this stage than in the first trial. We put this down to average room temperatures being slightly higher at this time of year.

Verdict: A useful, convenient and interesting little kit for schools wishing to work with protozoans. Good value.

References

1. Forthcoming edition of the SAPS Newsletter - *Osmosis* (in press).

Note : An illustrated version of this article appears on the members' section of our website.

PIC and place robot arm

Extensions of the control technology applications suggested in earlier articles are provided. In particular ways to add an interface, pcb kit and software routines to enhance applications of the inexpensive Robot Arm kit reviewed in Bulletin 206 , are indicated.

We continue our series on PIC controllers and the use of ready built inexpensive models to enliven 5-14 technology and Standard Grade Technological Studies. The washing machine models described in Bulletin 206 were examples of this approach. In Science & Technology Equipment News [1], we suggested the use of an inexpensive robot arm kit (see Figure 1) as an ideal way of illustrating control technology within 5-14 Environmental Studies. The assembly of the robot arm from the kit is straightforward and should be easily completed in about two hours. The arm can be controlled by a manual controller or, with the addition of software, by computer. We also suggested that the arm could, with a little modification, be used with PICAXE, Basic Stamp or PIC Logicator. Discussions with a number of Technological Studies teachers suggested that this was a project worth advancing.

We were however once again 'pipped at the post' by *Revolution Education* (see back page). They have produced an excellent, reasonably priced, interface board and PCB kit to be sold with the robot arm allowing control by Programming Editor/ BASIC software.

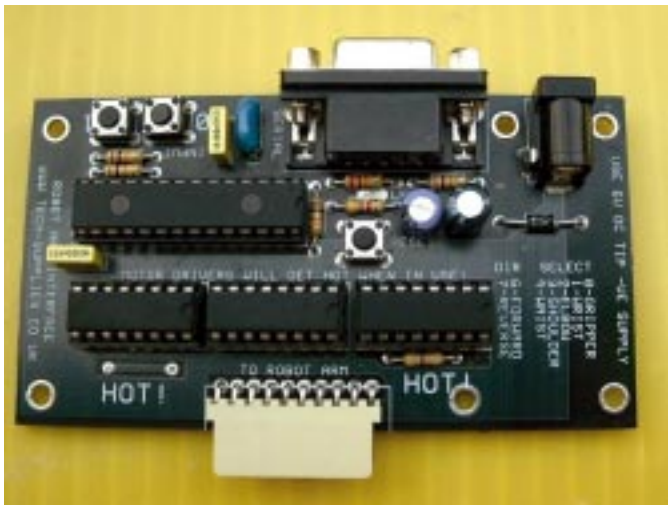

Figure 2 *Robot arm interface board with PICAXE28 micro-controller*

Robot Arm Interface

The interface board and PCB replace the manual control box and output board supplied with the kit. The microcontroller used in the interface is the PICAXE28 (PIC 16F872). This chip has 8 inputs, 8 outputs, 4 analogue channels and a 256 byte memory. The board (Fig. 2) also has 3 motor driver chips, L293D; they enable the 5 motors in the arm to reverse direction. Completing the board are 2 input switches that can be used to start or stop the robot arm. The board is designed for use with a 6 V power supply and not the 9 V supply used with other microcontroller boards. The boards are diode protected so no harm should arise if a 9 V supply is accidentally or deliberately connected. This extension to the use of

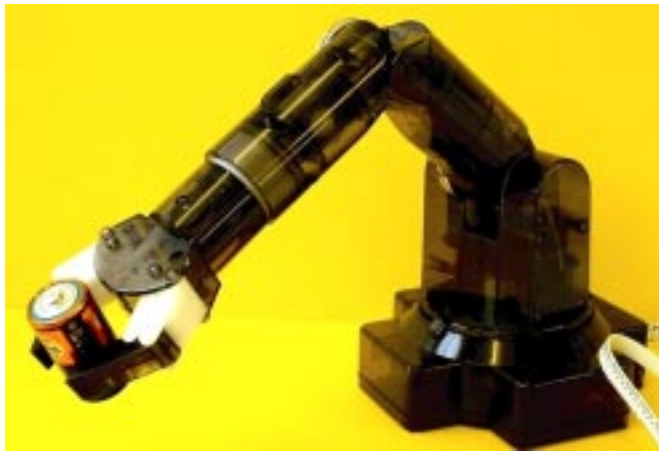

Figure 1 *Robot arm assembled from the Movit kit*

the arm now makes it a model suitable for applications in Standard Grade Technological Studies.

PCB Kit

A pupil competent in the use of a soldering iron could build the PCB board (Fig. 3), which replaces the output board from the kit (see Figure 4 opposite). The instructions on attaching the wiring to the board from the robot motors are again straightforward.

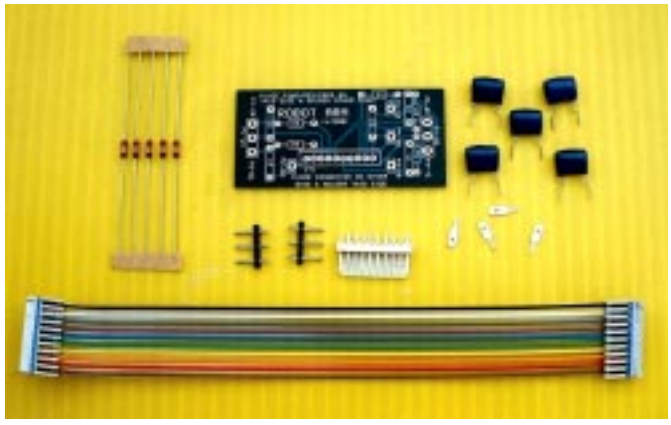

Figure 3 *Printed circuit board kit for robot arm interface.*

Programming

An encoding pattern is used to energise the individual motors by way of the 8 outputs of the microcontroller. The motor drive circuit carries out decoding. Whilst motors can be energised individually or together, the 6 V power supply supplied can only source enough current to output one motor at a time. Although by an error in programming we have successfully driven them in pairs, trying to energise

more will cause the supply to reset. Outputs 6 & 7 control motor direction, outputs 0 to 4 select individual motors. The test program, shown in the opposite column, is represented in both binary and decimal and will run through a sequence. This moves each of the motors in turn, first in a forward then in a reverse direction. It should be remembered that the inexpensive motors used in the kit are not sufficiently precise to repeat accurately an operation a number of times. In a more expensive robot, stepper or servo- motors would be used with a form of position transducer to provide feedback.

The Movit robot arm kit normally uses 4 D cells fitted in the base to drive the motors. As they are no longer used here, the arm becomes a little top heavy for classroom use and it is suggested that the interface and arm be secured to a baseboard. (See figure 5).

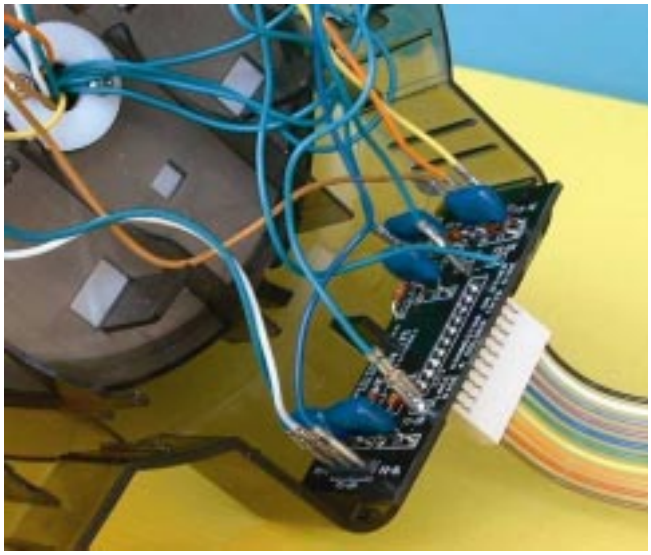

Figure 4 *Robot arm base showing the completed PCB kit board in position.*

Kit contents

The interface and PCB kit, at £85.00, includes:

- Robot Arm Accessory Kit
- MOVIT robot arm kit
- PICAXE controller PCB (populated)
- Motor connector PCB plus components (bare)
- Ribbon cable - MOD010

We would also suggest the addition of a 6 V power supply. Revolution's own PWR006 at £6.49 would fit the bill.

```
main:  let pins = 0
       if pin0 = 1 then loop
       goto main

                                    Decimal

loop:  let pins = %01000001        '65    gripper open
       pause 2000
       let pins = %10000001        `129   gripper close
       pause 2000
       let pins = %01000010        '66    wrist clockwise
       pause 2000
       let pins = %10000010        `130   wrist anticlockwise
       pause 2000
       let pins = %01000100        '68    elbow down
       pause 2000
       let pins = %10000100        `132   elbow up
       pause 2000
       let pins = %01001000        `72    shoulder down
       pause 2000
       let pins = %10001000        `136   shoulder up
       pause 2000
       let pins = %01010000        '80    waist anticlockwise
       pause 2000
       let pins = %10010000        `144   waist clockwise
       pause 2000
       goto main
```

Figure 5 *Interface and robot arm base.*

Summary and conclusion

Notwithstanding the comments on the use of inexpensive motors and the lack of feedback, both of which could be used in positive teaching strategies, we judge that the Robot Arm Accessory Kit will make an excellent and interesting addition for learning and teaching in control technology both for 5-14 and at the Standard Grade/Intermediate levels.

* * *

Tips on using the *Dazzle* TV Photo Show

Tips are given on using the brilliant Dazzle digital card reader. This is an inexpensive system which permits viewing of digital photographs with or without a computer.

We've been asked recently whether there was any way to avoiding using a computer if you simply want to view photographs taken with a digital camera. Apart from taking your wee memory card along to Boots, or the like, and saying "Print these please" there was nothing we could suggest. Then a friend of a SSERC staff member told him of an amazing wee box of tricks called the *Dazzle TV Photo Show*.

This device is basically a digital card reader system which can read *CompactFlash* (Type 1 and 2), *IBM Microdrive* and *SmartMedia* digital flash cards. The trick comes in being able to view the images on an ordinary television without going through all the rigmarole and hassle of first downloading to a computer. The typical retail cost of the TV Photo Show is just under £60. Suppliers include PC World and other similar retailers. If you're into web shopping then you can order the device and software more cheaply from Amazon or directly from Dazzle. Further details are given on the back page.

Setting up for TV viewing

The Photo Show box just needs a power supply connected to it and the TV output linked to the VIDEO IN socket on your television (sometimes labelled 'AV' and usually coloured yellow). If you view your camcorder classics then this is the socket you usually plug into. Adjust your television to view the incoming external video source and that's it!

We recommend that you always make sure the Photo Show box is OFF when you insert or remove your memory card. Insert your card, switch on the Dazzle and the television should display a menu. You also get a remote control which allows you to view your photos and control how you display them e.g. as thumbnails or full-size images. You can then go directly to the one you want and rotate it (especially useful for portrait orientation images) and zoom in or out. Alternatively there is a one button Slide Show facility with fancy dissolves between 'slides'.

Memories of all those 35 mm transparency slide shows of seaside holidays may well come back to haunt you! You can even hook up Dazzle to a video recorder and record the whole thing. It's the ideal present for all those homesick antipodean *rellies*. Afficiandos of the *Powerpoint* presentation - eat your hearts out!

Turning off the TV Photo Show involves clicking once on the red Power button on the remote control then pushing the slider switch to OFF. The memory card can then be safely removed.

Downloading images to a computer

Although downloading images to you computer is a relatively straightforward operation, we recommend that you follow the Instructions most carefully. We've devised a detailed set of step by step 'idiot proof' instructions. An illustrated version is available on our members' website.

We recommend that you follow these steps closely so as to ensure that your valuable photographs or memory card come to no harm.

Technicians' News

ASE, DfES and RS Project

A joint project is underway in England which will seek to develop "a career structure for science technicians in schools and colleges". The project, funded by the Department for Education and Skills (DfES) is to be undertaken jointly by the Association for Science Education (ASE), our sister organ-isation CLEAPSS (Consortium of Local Education Authorities for the Provision of Science Services) and the Royal Society (of London). This initiative follows on from the publication of the Report (July 2001) and Recommendations (Jan. 2002) arising out of the Survey of Science Technicians in Schools and Colleges organised jointly by ASE and the Royal Society. This latest joint initiative follows up work by CLEAPSS subsequent to publication of the survey results. Dr David Moore, one-time Chief Executive of ASE is managing the project.

Lab design and prep room survey

Another project with ASE involvement may well be of interest to technicians as well as science teachers. As part of its Laboratory Design Project the ASE is seeking examples of good design of preparation rooms. If you're able to assist in this process then contact the ASE Laboratory Design Project Officer: Andy Piggott, 71 Field Way, Chalfont St Peter, Gerrard's Cross, Bucks, SL9 9SQ. T: 01753 885222 F: 01753 887634 E: andy.piggott@btinternet.com

For further details of either of the above projects, see the ASE website at www.ase.org.uk.

News from STAG

The Scottish Technicians' Advisory Group hasn't been idle. Members of the group have produced a couple of useful guides, one related to safety in workshops and another updating guidance on electrical safety testing. These will be mounted on the SSERC members' website in due course.

Development for Updating School Chemistry

Don Sutherland, PT Chemistry at Deans Community High School Livingston, has recently been appointed, as a part-time Development Officer, to support a new Scottish based project intended to update and enliven school chemistry. We report here on the rationale for, and aims of, 'DUSC'.

Rationale

The last 10 years have seen a steady decline in the numbers of students opting to study chemistry to Degree/HND-level at UK universities. . For example, the figures for chemistry applications in 2000-2001 showed decreases of 7.7 % in the UK as a whole and 11.5 % amongst students from Scotland.

Answers to recent Scottish Parliamentary Questions have underlined the extent of this decline in the popularity of chemistry degree courses in Scotland. Over the last five years here has been a 27% drop in applications to chemistry courses, with an even greater drop (30%) in acceptances. This is partly a reflection of the decreasing number of pupils who choose to study chemistry at school to A-level and Higher. If these trends are allowed to continue, the consequences may well include substantially reduced government funding for university chemistry departments, a shortage of high calibre chemistry graduates for the UK chemical industry, and a general decrease in public awareness and understanding of the importance of chemistry in today's society.

The reasons for decline are varied and complex, but include the following:

- *increasing competition from subjects that are regarded by young people as more 'trendy' or more marketable, e.g. information technology, business studies, media studies*
- *a shortage of modern laboratory accommodation*
- *outdated equipment*
- *the perception that chemistry at school is a difficult subject*
- *the reduction in the level of exciting practical chemistry experienced at school, caused by perceptions of more stringent health and safety guidelines and ageing school laboratory facilities*
- *the poor public image of chemistry and the chemical industry*
- *the relative lack of scientific training across the primary school sector*
- *the need for updating subject knowledge and understanding and pedagogical skills across the secondary sector*

Aims of the Project

At individual school level, chemistry teachers have generally responded positively to the 'crisis' but there is still a clear message that more support is needed in the present difficult climate, particularly in the following broad areas:

1. Consistent access to up-to-date resources to enhance the delivery of the curriculum
2. Provision of continuing professional development that includes updates of subject content and methodology
3. Support from external sources to enthuse and excite pupils, and hence encourage them to select chemistry at school.

Project objectives

Specific targets for the DUSC project include:

1 *arrest the recent decline in numbers taking chemistry in school to Higher level*

2 *increase the percentage of students who leave school with a desire to undertake further study in chemistry*

3 *raise awareness of career opportunities in the chemical industry*

4 *co-ordinate and raise awareness of university initiatives to support chemistry at school level*

5 *provide opportunities for high-quality staff development in a wide variety of areas including the employment of 'enterprising' approaches to learning and teaching, e.g. making chemistry attractive through the use of investigative approaches, the use of group work to debate issues like global warming, the effective use of ICT and of formative assessment*

6 *provide opportunities for high-quality staff development in the basic classroom skills*

7 *co-ordinate and raise awareness of both new and existing CPD opportunities, e.g. the Chemistry Summer School and other quality in-service training sessions*

8 *build on existing links with agencies such as SSERC, LT Scotland, ISES, SETpoints, Careers Scotland and the chemical industry*

9 *support the development of the Scottish chemistry teachers' website, presently being initiated by BP*

10 *contribute to the ongoing review of chemistry being carried out by the Scottish Qualifications Authority (SQA)*

11 *provide support for probationary teachers*

12 *establish links with the other sciences*

Substitutes for peanuts

An increasing incidence of serious allergenic reaction to peanuts (and other nuts) has led to a search for suitable substitutes for use in common school practical activities. Some results of an evaluation of such substitutes, employed for simple calorimetry, are reported.

Using a burning peanut (groundnut) mounted, usually, on a seeker or dissecting needle to heat water in a boiling tube or similar container has long been a popular practical activity in schools. Unfortunately there is now a well documented history of significant problems with this simple application. These arise from the growing incidence of serious allergenic reactions to peanuts, and other nuts, in the school population. Some of these reactions may even be life-threatening and a proportion of children with such an allergy now carry an *Epipen* so that a dose of adrenalin can be rapidly administered should they be in danger of full-blown anaphylactic shock.

Figure 1 *'Traditional' simple calorimetry. A piece of the proprietary snack - a 'Wotsit' burning on a mounted needle.*

Substitutes selected

There have been a number of suggestions for suitable substitutes either published or suggested via the professional grapevine. To date, we had seen little hard comparative data on many of them. We decided to try out some of these suggestions for ourselves and report on our findings. We also revisited some of the other simple calorimetric tricks developed earlier by SSERC and published several (well, ok, thirty) years ago in a past edition of this *Bulletin* [1].

Amongst a number of dafter ideas, the nut substitutes we trialled more recently included: orange peel; raisins; marshmallows, proprietary snacks such as *Wotsits* and - slightly more upmarket - olives. Using other apparatus allowed us also to try biscuits; cheese; bread, vegetable oil, pasta and crisps.

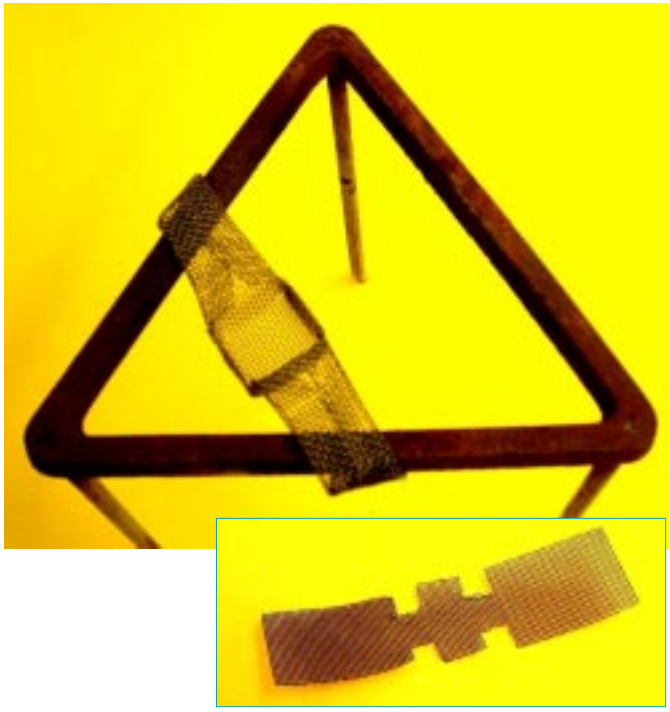

Figure 2 *The gauze basket referred to in the text. Used as a 'micro' grate this ensures an excellent supply of air to a burning foodstuff.*

Figure 3 *(Inset) shows how the basket is fabricated from a single piece of gauze cut using a template. The template is available on request from SSERC or can be dowloaded from our members' website.*

Methods trialled

We tried each of the substitutes both in the 'traditional' mode, impaled on a mounted needle or seeker (Figure 1) where that proved possible as well as in the SSERC wire basket or mini-grate system (Figure 2). In each case the temperature rise was recorded in 10 cm^3 of water in a 350 x 150 mm boiling tube held at a standard distance above the burning foodstuff.

A few hints and tips on some of the more novel suggestions should prove useful.

With ***orange peel*** it proved important to dry it out thoroughly removing as much pith as possible. The peel can be cut into strips or discs using a cork borer and burned on a seeker or in a wire basket. Burning was reasonably successful and the results quite encouraging (see Table 1 overleaf).

Raisins proved difficult to burn completely. ***Marshmallows***, unsurprisingly, burned very quickly and the results were extremely messy.

Wotsits burned really well giving a temperature rise of 36°C in 10 cm^3 of water . They produced a fair bit of flame but they were easy to get started burning. Once alight, they continued burning for a long while (See Figure 1, above).

Olives, either black or green, proved an unexpected success although they did require some advance preparation. We bought ours bottled in brine from Tesco. We then air-dried them at 50° C for 3 days. One burning olive proved capable of boiling 10 cm^3 of water in a 350 x 150 mm tube.

Basket method

This method is recommended either for the foodstuffs which are awkward if not impossible to mount on a needle or seeker or where a good supply of air as an updraught is vital if the foodstuff is to be kept burning.The small basket was made from bunsen burner gauze (see Figures 2 and 3 preceding page). Superwool 607 (a new type of mineral wool described in Bulletin No206) was used to contain the substances for burning.The Superwool liner was only necessary when burning liquids such as vegetable oils, or materials likely to break up (dried bread) or melt (cheese).

A watch glass was tared on a balance.The basket was then placed on the watch glass and in turn weighed. Using a pipette or spatula 0.5g of the substance was added to the basket or placed on the wool liner in the basket.The basket was then hooked onto a tripod stand (see Figure 2). The substance was first ignited with a Bunsen flame which was withdrawn once the foodstuff was burning properly. A boiling tube containing 10 cm^3 of water and a thermometer was placed over the substance in the basket and the subsequent rise in the water temperature noted and recorded.

Summary and conclusions

Both olives and vegetable oils provide effective substitutes for peanut as an example of a 'fatty' food.The olives, although relatively expensive, have the advantage that they will work well in the 'traditional' method - impaled on a mounted needle or seeker.The use of oil requires the added complication of a gauze basket lined with Superwool.

For examples of mainly carbohydrate based foods, yielding much less energy per unit mass than fats, look no further than bread or pasta. Other, less recent, trials of ours however have also shown some carbohydrate based breakfast cereals (we had selected Kellogs *Start***)** can also work well [2].

Material	Mean rise °C	Comments
plain biscuit	36	burned well
'Wotsit'	36	easily ignited and burned completely
dried fruit (raisins)	NA	difficult to get to burn completely and not recommended
cheese (Cheddar type, dried)	26	best used in basket
marshmallow	6	burned rapidly and messily not recommended
bread (dried)	24	basket needed
orange peel (air dried and cut in strips)	26	surprising but presence of oils in peel may explain effectiveness
olives (dried)	82	water boils
vegetable oil	82	as above, oils to be carefully selected some may contain nut products
pasta (macaroni)	24	check for nut traces
potato crisps	39	again effective probably because of residues of fat or oil

Table 1 Typical results for temperature rise in 10 cm^3 of water in a 350 x 150 mm boiling tube 10 mm above each of a range of burning foodstuffs.

References

1. *Energy content of foods* Bulletin 63 SSERC 1973
2. *Zany energy conversions* Bulletin 157 SSERC 1987

Algal cells and photosynthesis

The Science and Plants for Schools (SAPS) project recently published an interesting and novel set of ideas for investigating photosynthesis. These borrow the idea of using an alginate gel to immobilise enzymes or yeast cells and apply it to the use of cells of an unusual and appealing species of alga called *Scenedesmus quadricauda* (see inset). The work was mainly that of Dr Deborah Eldridge, Head of Science at King Ecgbert School, Sheffield. It was carried out during a SAPS Robinson Schoolteacher Fellowship at Robinson College, Cambridge, in 2002.

We have tried out the published protocol for the immobilisation and the suggested investigation on the effects of varying light intensity. There are a number of minor improvements which we might suggest as a result of those trials. None the less we also have to report that we were favourably impressed with both the novelty and general effectiveness of the techniques described in SAPS Student Sheet 23 in *Osmosis* number 23.

Our suggestions for minor improvements would include:

1. Additional steps are taken to ensure that algal suspensions used for immobilisation hold high densities of cells.
2. A source of high intensity, yet 'cool' light is used. We used a 20 W *Aqua-Glo* strip light a type of fluorescent tube intended to illuminate aquaria.
3. The bicarbonate indicator used to detect falling carbon dioxide concentrations is correctly prepared. In particular, that they be fully diluted from any bought-in 'stock' solutions and properly equilibrated with air prior to use.

This use of immobilised algal cells is described on the SAPS website from which further information may be downloaded. A fuller version of this SSERC note, with more hints and tips, is to be posted on our members' website. *Scenedesmus quadricauda* is available from Sciento - see back page.

Science 2020 report

The Science 2020 conference has been reported on previously in these pages. Such a conference was one of the key outcome promised as part of the Science Strategy Review. The conference was duly held in Edinburgh in the Spring of this year. The summary report, compiled and drafted by ASE Scotland, is now available on the conference website. A copy has also been posted on our own website.

SSERC AGM

SSERC's Annual Conference and the Company AGM will be held at the Glasgow Science Centre on Friday 21st November 2003. As in recent years the subject matter of the conference will be linked to the Science Strategy for Scotland in general and to key issues which have arisen as a result of the formulation and publication of the strategy.

This year's major theme will be CPD for science teachers and technicians. CPD was flagged up at the Science 2020 conference as a critical issue for science educators. We hope to have a keynote speaker from the Scottish Science Advisory Committee as well as contributions from a number of the key players here as well as one or two from furth of the border.

Trade News

iButton Datalogger and PIC

Revolution Education is now offering two versions of the *iButton* temperature data logger. A standard version can log temperature from –10 °C and +85 °C. The new 'human body' version measures and logs between +15 °C and +46 °C. Both are offered at the lower price of £10.00. An iButton Starter Pack, which is available for £38.00, consists of a docking adapter, CD ROM software for *Windows*, a manual and one standard iButton. We reviewed the standard pack in issue 24 of our 5-14 Newsletter.

A new enhanced 18 pin PIC (programmable interface controller) the PIXCAXE-18A, has been introduced with twice the memory of 18 pin chips in use in schools. Much has been made of this extra memory; the Revolution website lists these additional features as follows:

"The PICAXE-18A supports all the PICAXE-18 commands and features, with the following enhancements:

Program memory twice as long (approx. 80 lines rather than 40)

Full separate 256 byte data memory (read/write commands)

High resolution ADC on inputs 0-2 (readadc command)

A number of new commands are supported.These include:

Interrupt feature on inputs (setint command)

Accurate digital temperature sensor interface (readtemp command)

Accurate 1-wire clock interface (readowclk, resetowclk command)

Read serial number from any Dallas 1-wire device (e.g. iButton) (readowsn command)

Servo control on all 8 outputs (servo command)

Infrared controller interface on input 0 (infrain command)

Computer keyboard interface on inputs 6 and 7 (keyin, keyled command)"

We shall be offering further ideas on the use of the new PICAXE18A chip in our autumn/winter bulletin.

For projects in S1/S2, or engineering club work, there are now new PICAXE-08 projects available at under £3 each. These include dice, alarm, and a cyberpet.

PASCO serial to USB adaptor

Following publication of a note on apparently cheaper substitutes for this device, in this section of the last issue, we've had some comments from PASCO in California. PASCO have stated that their own USB adaptor is in fact specifically designed and purpose-built for use with its own interface devices and software providing a data transfer rate that is greater than standard USB to serial devices. They are of the opinion that such standard USB adaptors, although markedly less expensive, won't necessarily give the best performance nor will they be 'future proof' against PASCO's own design changes or other product improvements. Please note also the change to the PASCO address details on this page.

Erratum WPA colorimeter

When we reviewed the WPA CO7500 model in Bulletin 208 we omitted to list Philip Harris amongst the suppliers.

Addresses

Association for Science Education, College Lane, Hatfield, Hertfordshire, AL10 9AA. T: 01707 283000, F: 01707 266532, W: www.ase.org.uk

Bio-Rad Laboratories: T: 0800 181134, W: www.bio-rad.com

Blades Biological, Cowden, Edenbridge, Kent, TN8 7DX. T: 01342 850242, F: 01342 850924, E: info@blades-bio.co.uk W:www.blades-bio.co.uk

British Standards Institution (BSI), Chiswick High Road, London, W4 4AL. T: 020 8996 9001, F: 020 8996 7001, W: www.bsi.org.uk

Dazzle - see www.dazzle.com or enquire of the main UK distributors : Koch Media, Thomas House, Hampshire International Business Park, Basingstoke, Hampshire RG24 8WH T: 01256 707767 F: 01256 707277 W: www.kochmedia.co.uk Dazzle products are also sold by the following firms (although not necessarily all currently sell the TV Photo Show product):

Amazon, W: www.amazon.co.uk

PC World, W: www.pcworld.co.uk

Dixons, W: www.dixons.co.uk

DfES (DfEE) Publications, PO Box 5050, Sherwood Park, Annesley, Notts., NG15 0DJ. T: 0845 60 222 60, W: www.dfes.gov.uk

Philip Harris Education:

E6 North Caldeen Road, Calder Street, Coatbridge, Lanarkshire, ML5 4EF. T: 01236 437716, F: 01236 435183.

Novara House, Excelsior Road, Ashby Business Park, Ashby-de-la-Zouch, Leicestershire, LE65 1NG. T: 0870 6000193,F: 0800 7310003, W: www.philipharris.co.uk/education

HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 2WA. T: 01787 881165, F: 01787 313995.

Institute for Science Education in Scotland *(ISES)* c/o The University of Edinburgh, Weir Building, The King's Buildings, West Mains Road, Edinburgh EH9 3JY T: 0131 650 7266 F: 0131 650 5738 E: elaine.anderson@ed.ac.uk

PASCO scientific, 10101, Foothills Boulevard, Roseville, California 95747 USA. W:www.pasco.com

Revolution Education Ltd., 4 Old Dairy Business Centre, Melcombe Road, Bath BA2 3LR T: 01225 340563 W: www.rev-ed.co.uk

Royal Society of Chemistry, Burlington House Piccadilly, London W1J 0BA T: 020 7437 8656 F: 020 7437 8883

Science and Plants for Schools (SAPS), Homerton College, Cambridge, CB2 2PH T:01223 507168 W: www.saps.plantsci.cam.ac.uk

SAPS Biotechnology Scotland Project, 2nd Floor, St Mary's Land, 23 Holyrood Road, Edinburgh EH8 8AE, T: 0131 558 8212 F:0131 558 8191 E: SAPS@sserc.org.uk

AND AT: *Quest Biotech Laboratory, Dollar Academy, Dollar, FK14 7DU. T: 01259 743753.*

Sciento, 61 Bury Old Road, Whitefield, Manchester, M25 5TB T:0161 773 6338