

The Clubbers' Guide School biology clubs

Sue Howarth

The STEM team at the University of Worcester support STEM activities in schools in Herefordshire and Worcestershire. Part of this help includes suggesting activities for STEM clubs. As the biologist on the team, I have been asked by teachers for ideas to use in biology clubs. This article was prompted by feedback that these ideas might be useful to a wider audience.

Some ideas for activities for biology clubs are shown in Figure 1. These ideas are explored in more detail in the following sections. Most of the activities described could be modified to suit students, aged between 11 and 19 years, of different abilities and enthusiasms. A number of the activities could also be amended to suit science clubs that are not specifically focused on biology.

Invited speakers

The Biology4all Speakers Database (see *Websites* at the end of this article for the URL for this and other resources mentioned in the text) currently has details of 543 talks offered by 472 university

and research staff willing to visit schools and colleges. The database gives information about how far speakers are prepared to travel and you can search by postcode, speaker name or institution.

... an incredibly useful database for teachers. Every time that I have used it (and this is in two schools now) we have had an excellent speaker and very often at no cost. (Quote from the database website)

To increase involvement, students could search the database and, when an agreed speaker is found, they could be asked to write the invitation, advertise the event, look after the speaker before and after the event, and write up an account for the school magazine or website. STEM Ambassadors are another option for finding speakers for club events.

Visits, trips and expeditions

There is increasing evidence that learning outside the classroom is beneficial to most students,

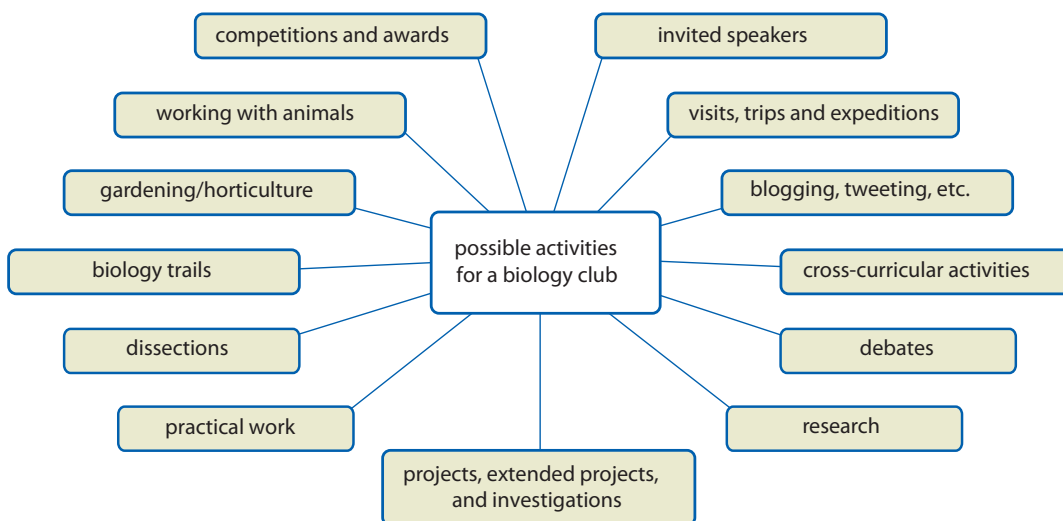


Figure 1 Ideas for activities that could be run as part of a programme for a school biology club

such as in the Ofsted report *Learning Outside the Classroom: How Far Should You Go?* (Ofsted, 2008). Learning outside can include making use of the school grounds or trips further afield, perhaps to museums (Figure 2). *The Biologist*, a journal of the Society of Biology, is currently running a series about museums. Each issue is focusing on one museum. For example, the Museum Section in the October/November 2013 issue focused on the Jenner Museum in Berkeley, Gloucestershire, where Edward Jenner investigated inoculating against smallpox.

The Open University website has a useful, free resource for ‘enhancing pupil learning on museum visits’. Other venues to consider could include the following.

- **Botanic gardens:** Pre-visits are always a good idea to see what is available and to meet the education officer.
- **Cinemas:** Watch out for films with suitable biological content; for example, *Contagion* (Figure 3) is relevant for 17- to 18-year-olds studying infection and immunity. The Internet

Movie Database (IMDb) is useful for checking content and suitability.

- **Field Studies Council centres:** One-day visits may be possible if distance allows, or consider residential stays for more in-depth ecological studies. More information can be found via the Field Studies Council (FSC) website. There are also a number of non-FSC centres worth considering, such as Leeson House Field Study Centre in Dorset.
- **Nature reserves:** Ideal if local to the school. Your nearest Wildlife Trust should be able to advise on visits and wardens may be able to give guided tours.
- **Research institutions:** Universities, commercial research organisations such as pharmaceutical companies, and large museums such as the Natural History Museum in London may be able to offer ‘behind the scenes’ tours.
- **Zoos:** Like botanic gardens, zoos usually have an education officer and bespoke talks and tours may be arranged to suit students.

1. Is this still the case in current issues, or does the sentence need to be amended now?

2. Could you perhaps add another more recent example?

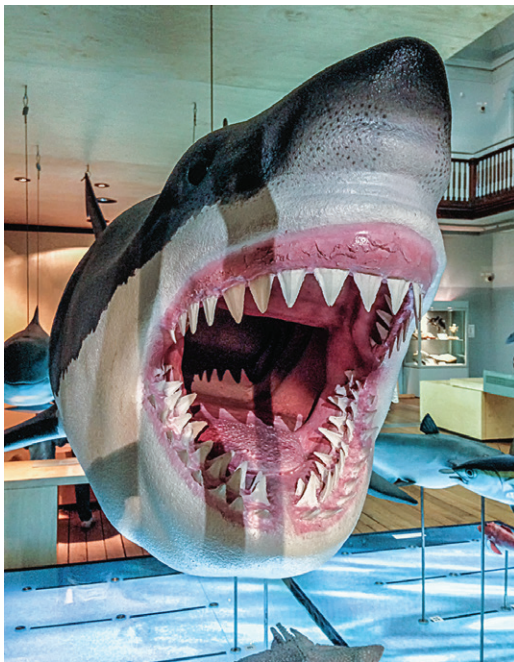


Figure 2 Visits to museums, such as the Great North Museum, also known as the Hancock Museum, situated in Newcastle, can extend biological knowledge in exciting and motivating ways. This shark is a popular exhibit in the Hancock Museum.



Figure 3 In the movie *Contagion* (2011), Matt Damon, Kate Winslet and Jude Law race against time to develop a vaccine against a lethal virus

Club members could also take part in an expedition. Obviously, these take greater planning. Various companies offer biology-based expeditions; for example, Operation Wallacea and Discover the World. Some companies also offer help with fundraising so that expeditions to Malaysia, Peru, Iceland and other distant destinations might be possible.

Websites, blogging and tweeting

Creating a website and writing blogs and tweets are some of the many opportunities for club members to use information and communication technology (ICT) to share and enhance their knowledge of biology. A club website could host pictures of activities and reports, so advertising the club to other potential members and involving parents. Blogs could be about topical biological issues. Tweets could be about a particular topic. A great example of the biological use of *Twitter* is ‘organelle wars’. Here, students campaign, via tweets, for their organelle to be voted for as the most important in the cell (Howarth and Scott, 2013). *Skype* allows linking with other schools, and, possibly, time zones allowing, with schools in other countries. This could provide a chance to compare common issues such as diets and sustainability.

Cross-curricular activities

One of the best things about biology clubs is that you can look at areas of biology not usually covered in lessons and at how biology links with other subjects. It might be possible to study animal behaviour beyond woodlice in choice chambers, which then leads to the study of human behaviour, or psychology. Other cross-curricular topics for a biology club programme might include:

- historical biology, including the history of medicine;

- an adventure into the emerging field of proteomics which links with the use of ICT and interrogating databases;
- the biology of food, which links with food technology (note that 2–6 June 2014 is **Healthy Eating Week in the UK**);
- **environmental biology with geographical links.**

Some schools have successfully linked biology and poetry. The Fossil Club at the Thomas Hardy School in Dorchester (Figure 4) has also included music, photography and drama, all linked to fossils, in their activities. The school’s website is well worth a look for inspiration.

Debates

Debating can prove to be both popular and motivating, particularly if the club members can choose, within reason, the topic. For additional help, the English department may be able to provide support with some ground rules or advice. Seasonal twists can add an element of fun; for example, a ‘sleigh’ debate could replace the ‘balloon’ in the traditional balloon debate, where participants have to make a case not to be thrown out of the hot air balloon/sleigh, usually by making a case to convince others, who vote at a later stage, how important their given job/role/function is.

Research

What could be more motivating and exciting than to carry out ‘real’ research? Primary school pupils’ research into vision in bumblebees was good enough to be published in *Biology Letters*, the journal of the Royal Society (Lotto and O’Toole, 2012), and there should be no reason, given time and encouragement, why secondary school pupils would not equal or better this. There is certainly scope for biology clubs to provide opportunities for students to explore areas of interest further than lessons allow. This aligns with the latest

3. The June issue of *SSR* is only going to press three weeks before this, so it will be a close-run thing as to whether many (any) teachers will read this in time. Perhaps we should remove it. What do you think?

4. I converted this to a bulleted list. Did you mean this last item to be joined up with the “biology of food” item (you didn’t have a semicolon before it)? If so, it will need careful punctuation and perhaps rephrasing to join them up.



Figure 4 The website header of the Thomas Hardy School Fossil Club

Ofsted report about good science education, *Maintaining Curiosity* (Ofsted, 2013).

Older members of a biology club may be interested in the Nuffield Research Placements scheme (formerly the Nuffield Science Bursaries scheme). All students studying a STEM subject in the first year of post-16 courses are eligible. Placements may be in universities, research institutions, commercial companies or voluntary organisations and take place over 4–6 weeks during the summer holidays.

The Royal Society Partnership Grants scheme is also worth considering. This helps schools to run exciting and innovative projects in partnership with professional scientists.

5. I inserted this comma to clarify that the word "extended" does not apply to "investigations" – OK?

Projects, extended projects, and investigations

Club time could be usefully used to allow students to carry out projects and investigations of different lengths. Chapter 11 in *Success with STEM* (Howarth and Scott, 2013) has an 'Ideas Bank' that suggests simple or pilot activities, followed by ideas for extending these into projects. Other sources of ideas include the CREST 'Pick Up and Run' project resources webpage and the OPAL (Open Air Laboratories) surveys, which include opportunities to investigate soils, earthworms and biodiversity.

Successful projects could lead to presentations at local and national science fairs, such as The Big Bang Fair (UK Young Scientists & Engineers Fair), held in March every year.

Practical work

Practical work in many schools in the UK often appears driven by the need to acquire good examination grades, usually by writing about practical work done previously. The practical skills needed by employers and for further study currently do not seem to be a priority (Abrahams, Reiss and Sharpe, 2013). Until these priorities change, biology clubs can provide opportunities for students to engage in practical work. The kit, materials and facilities that are available may dictate what is possible, but a hunt around the prep room and laboratory cupboards might yield interesting equipment for novel practical work. If you have binocular microscopes then the study of pond or river water is always fascinating (Figure 5).

An alternative is to buy in some ready-made kits, such as the DNA necklace kit supplied by Bio-Rad. This is not cheap, but could keep up to 36 students engaged for about an hour, for a cost of about £3/head. The students get their own DNA in a necklace to take away.



Figure 5 Macro-organisms collected from a river; using a binocular microscope with cavity slides will reveal many more organisms

Dissections

One aspect of practical work that many students enjoy is the opportunity to carry out dissections (Figures 6 and 7). Dissecting does not suit all students so it is wise to sound out views in advance and provide alternative activities if appropriate. However, aspiring ‘medics’, those interested in studying biology at a higher level and those just interested in what makes living organisms ‘tick’ will appreciate the chance to explore anatomy by dissection. The ethics of dissection in schools could make an interesting topic for debate (see section above on debates). Generally, if an animal has already been killed for human consumption, it is not only safe to dissect in school but also less likely to raise ethical issues. A relevant and useful discussion thread about what may be dissected in schools, and whether it should be, can be found in the archives of the Biotutor discussion list. Of course, plants may also be dissected; some exotic flowers and fruits can be purchased relatively cheaply if past their best for display or eating, and can provide interesting challenges to dissect and identify.

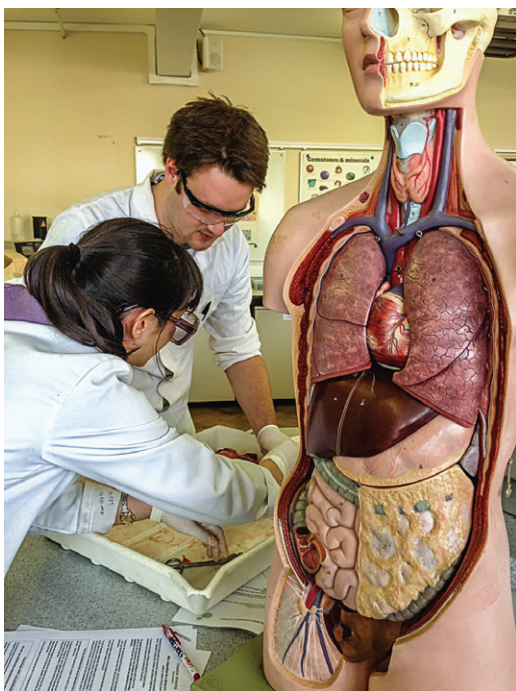


Figure 6 University of Worcester trainee science teachers enjoying a dissection workshop using material from butchers’ shops and fishmongers

Material appropriate for dissection might include some items from the following list:

- heart and lungs;
- kidneys;
- eyes;
- pig’s trotters;
- salmon heads;
- whole fish such as mackerel;
- squid;
- octopus;
- owl pellets;
- flowers;
- exotic fruit.

If any of these have already been dissected in lessons, students still might like to try them again, perhaps with more freedom and time to explore in detail.

Biology trails

Adaptable for all ages, biology trails can be developed for club members to do as an activity or, even better, for them to create one or more trails themselves. Even the inside of the school has possibilities for a biology trail:

- identifying plants on windowsills;
- posters on walls;
- spider webs if the cleaners are not too assiduous, etc.

Using the ‘I Spy’ format can work well, with points collected for items found. The use of the school grounds extends possibilities enormously. Incorporating a map, photos, questions (with answers), facts, etc., could lead to a trail suitable for use by visitors including primary school pupils. Alternatively, creating a biodiversity map of the school grounds would provide a useful record that could be monitored and updated at intervals.

Gardening/horticulture

Many students like growing plants, especially if they are edible and/or they can take them home. The Royal Horticultural Society (RHS) Campaign for School Gardening is worth considering joining. Once the free registration is completed, schools are eligible for a free starter kit. Other benefits are rewards and certificates for progress via a ‘benchmark scheme’ and access to information and advice from regional advisers.

A few years ago, a competition called ‘Making a Mint’ sent schools, on request, packets of mint



Figure 7 School students dissecting regurgitated owl pellets, obtained from a local Barn Owl Trust and sterilised by heating; the students identified the bones from a pellet to work out the owl's diet

seeds and encouraged students to be commercially innovative with their plants. The competition has now finished but, for little more than the cost of a packet of mint seeds, students could still produce a variety of products to sell, such as dried mint, potted mint plants and mint-flavoured lip balm (with due regard for health and safety for cosmetic products). Mint is particularly interesting to work with as it tolerates a wide range of soils and conditions, it can be grown inside or outside, and it comes in a number of varieties with interesting textures and scents (Figure 8)

Working with animals

A variety of animals may be kept in school, although there are opposing views about this, with the RSPCA disagreeing with keeping animals in school as pets. However, if colleagues, including technicians, agree and there are strategies in place for the school holidays, live animals can make a biology lab environment special and provide material for biology club

activities. Animals that are relatively easy to keep in school, once the relevant animal care is researched and equipment such as suitable tanks obtained, include:

- giant African land snails, *Achatina fulica*;
- giant millipedes, *Archispirostreptus gigas*;
- hissing cockroaches, *Gromphadorhina portentosa*;
- stick insects, for example *Carausius morosus*;
- brine shrimps, *Artemia* spp.;
- fish;
- bearded dragons, *Pogona vitticeps*;
- gerbils (which cleaner and more active during the day than hamsters), *Meriones unguiculatus*.

Club activities could start simply with animal care – cleaning out the tanks or cages and restocking food and water. Such simple activities alone can prove engrossing for students, but could be extended by consideration of habitat enrichment and observations of animal behaviour.



Figure 8 The runner-up of the Society of Biology's Biology Teacher of the Year Award 2012, Dr Richard Spencer, with students from SRC Bede Sixth Form, Billingham; note the tray of mint plants and the notice-board about their 'Plants R Mint' project

Clear advice on how to handle the animals is imperative, along with adequate hand washing afterwards. Appropriate risk assessments are also needed for working with animals.

The Association for the Study of Animal Behaviour (ASAB) has webpages dedicated to promoting the study of animal behaviour in schools, with many free, downloadable resources. **The association also produces a free termly newsletter, *Feedback***, which has articles, exercises, animal cameos and suggestions for activities. There is also a free 'nest box with video camera' loan scheme for schools that could form the basis of engaging not just club members but the whole school if you get occupants and can view eggs hatching. The ASAB education officer, Charlotte Evans, will visit schools to give talks and workshop sessions for students, from infant classes to sixth-formers.

Competitions and awards

Almost all of the above ideas and activities could lead to competition entries and/or awards of some kind. Some to consider include the following.

- **Biology Challenge:** This competition, for students aged 13–16, encourages interest in biology beyond the curriculum, with online fun questions about anything to do with biology.
- **British Biology Olympiad:** This competition, for students aged 16–19, runs at several levels, with the ultimate aim of selecting the UK team for the International Biology Olympiad.
- **CREST Awards:** These can involve very short projects (Discovery Awards) or projects lasting several weeks full time (Gold Awards), with Bronze and Silver Awards as intermediate stages. Full support is given on the British Science Association website, including how to get started.
- **Google Science Fair:** This worldwide 'fair' is an online competition, challenging students aged 13–18 to carry out scientific investigations.
- **International Brain Bee:** Aimed at students aged 14–17, this international neuroscience competition aims to motivate students to learn about the brain.

6. The latest issue on their website seems to be from November 2011, so perhaps it has been discontinued. Do you know anything about this?

- **MISAC (Microbiology in Schools Advisory Committee) Annual Competition:** For students aged 11–16, each year has a topic linked to microbes and fungi and the National Curriculum.
- **Royal Society of Chemistry Bill Bryson Prize:** This is for excellence in science communication and each year has a theme; for example, the 2014 theme is to answer the question ‘*Where is the art in science? Where is the science in art?*’ Entries are accepted from anyone aged 5–19 and the format can be innovative as long as it is good communication.

Students interested in joining a biology club may also like to join BioNet, which is organised by the Society of Biology, the UK’s leading professional body for the life sciences. For a small fee, currently £5 per year, members receive an e-subscription to *The Biologist* magazine, as well as a quarterly newsletter with the latest biological news, events and careers advice, as well as articles, adding depth to topics studied in school.

Conclusion

The activities described above could be used as a starting point for drawing up a varied programme for a biology club. Some of the categories overlap, such as research and projects, but the headings

References

- Abrahams, I., Reiss, M. J. and Sharpe, R. M. (2013) The assessment of practical work in school science. *Studies in Science Education*, **49**, 209–251.
- Howarth, S. and Scott, L. (2013) *Success with STEM*. Abingdon: Routledge.
- Lotto, B. and O’Toole, A. (2012) *Science is for everyone, kids included*. A TED talk. Available at: www.ted.com/talks/beau_lotto_amy_o_toole_science_is_for_everyone_kids_included.html. The article published in *Biology Letters* is available at: rsbl.royalsocietypublishing.org/content/7/2/168.full.pdf+html.
- Ofsted (2008) *Learning Outside the Classroom: How Far Should You Go?* London: Ofsted. Available at: www.lotc.org.uk/wp-content/uploads/2010/12/Ofsted-Report-Oct-2008.pdf.
- Ofsted (2013) *Maintaining Curiosity: a Survey into Science Education in Schools*. Manchester: Ofsted. Available at: www.ofsted.gov.uk/resources/maintaining-curiosity-survey-science-education-schools.

Resources

- Association for Science Education (ASE) conference information: www.ase.org.uk/conferences.
- Association for the Study of Animal Behaviour educational resources: asab.nottingham.ac.uk/education/index.php.

have been used to demonstrate the range of activities that are possible. It is usually motivating for students to be involved in decisions, so the ideas in this article could be shared with students who could then draw up the programme of activities that they would like.

Some of the activities have health and safety issues mentioned. All practical work with students needs a risk assessment but, once done, these only need updating when the activity is repeated or if circumstances change.

Further ideas for biology club activities could come from relevant staff professional development opportunities. The Association for Science Education (ASE) regional and annual conferences are always sources of new ideas. So also are the inspirational Science and Plants for Schools workshop for post-16 biology teachers and The Goldsmiths’ Company Science for Society courses, both held during the summer.

Teachers who run extracurricular clubs are often inspirational teachers in lessons. If this is you, or if you know a great biology teacher, consider a nomination for the School Biology Teacher of the Year Award (11–18 category). Run by the Society of Biology, this award usually opens in Biology Week; in 2014, Biology Week will be 12–18 October.

7. I have inserted the heading “Conclusion” here, as this is no longer part of the “Competition and awards” section. Actually, the previous two sentences about BioNet are also not part of that section, so arguably that needs to be in a section of its own (it wouldn’t work for those to start the Conclusion section). How would you like to handle this?

- Biology4all Speakers Database: www.biology4all.com/speakers_database/index.asp.
- Barn Owl Trust: www.barnowltrust.org.uk.
- Biology Challenge: www.ukbiologycompetitions.org/biology-challenge.
- Biology Week: www.societyofbiology.org/get-involved/biologyweek.
- BioNet: www.societyofbiology.org/membership/individual-membership/bionet.
- Bio-Rad DNA necklace kit: www.bio-rad.com/en-uk/product/genes-bottle-kit.
- Biotutor discussion list – information about the discussion list and on joining (which is free) can be found at www.biology4all.com/biotutor.asp. Once you have joined, you have access to the archives.
- British Biology Olympiad: ukbiologycompetitions.org/british-biology-olympiad.
- CREST Awards: www.britishsienceassociation.org/crest-awards.
- CREST ‘Pick Up and Run’ project resources: www.britishsienceassociation.org/crestresources.
- Discover the World: www.discover-the-world.co.uk/school/trip/en.
- Field Studies Council: www.field-studies-council.org.
- Google Science Fair: www.google-sciencefair.com.

Science notes

- Healthy Eating Week, 2014: nutrition.org.uk/foodinschools/programme/healthweek.
- International Biology Olympiad: www.ibo-info.org.
- International Brain Bee: www.internationalbrainbee.com.
- Internet Movie Database (IMDb): www.imdb.com.
- Jenner Museum ('Dr Jenner's House'): www.jennermuseum.com.
- Leeson House Field Study Centre: www.leesonhouse.com.
- MISAC Annual Competition: www.misac.org.uk/competition.html.
- Natural History Museum – School activities: www.nhm.ac.uk/education/school-activities/index.html.
- Nuffield Research Placements: www.nuffieldfoundation.org/nuffield-research-placements.
- OPAL surveys: www.opalexplorenature.org/CRESTsecondary.
- Open University – Enhancing pupil learning on museum visits: www.open.edu/openlearn/education/enhancing-pupil-learning-on-museum-visits/content-section-0.
- Operation Wallacea: opwall.com.
- Royal Horticultural Society (RHS) Campaign for School Gardening: apps.rhs.org.uk/schoolgardening/teachershome/aboutthescheme/default.aspa.
- Royal Society of Chemistry Bill Bryson Prize: www.rsc.org/Education/events-and-competitions/bill-bryson-prize.
- RSPCA frequently asked question – Should we have a classroom pet?: www.rspca.org.uk/education/utilities/faq/-/question/TEACH_ShouldWeHaveAClassroomPet/category/Animals%20in%20schools.
- School Biology Teacher of the Year Award: www.societyofbiology.org/get-involved/awards-and-competitions/school-teacher-of-the-year.
- Science and Plants for Schools summer workshop for post-16 biology teachers: www.saps.org.uk/secondary/cpd.
- Society of Biology: www.societyofbiology.org.
- STEM Ambassadors: www.stemnet.org.uk/contact-will-help-you-find-stem-ambassadors-in-your-region.
- The Big Bang Fair (UK Young Scientists & Engineers Fair): www.thebigbangfair.co.uk.
- The Biologist* (Society of Biology): thebiologist.societyofbiology.org/index.php/biologist.
- The Goldsmiths' Company Science for Society courses: www.thegoldsmiths.co.uk/charity-education/education/science-for-society-courses.
- Royal Society – Partnership Grants scheme: royalsociety.org/education/partnership.
- Thomas Hardy School Fossil Club: www.fossilclub.org.
- Wildlife Trusts: www.wildlifetrusts.org.

Sue Howarth is a Senior Lecturer, Science Education, at the University of Worcester and is co-author of *Success with STEM*. Email: s.howarth@worc.ac.uk
