

Biology practicals that work: SAPS drop-in sessions at the ASE Annual Conference 2017

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ABSTRACT This article reviews the practical plant biology workshops presented by Science and Plants for Schools (SAPS) at the Association for Science Education Annual Conference 2017. The well-received workshops enabled attendees to try out SAPS practical investigations, with the support of experienced 'experts' and colleagues. The resources presented, including the SAPS resources on plant disease, fit the new GCSE science and biology A-level curricula in England and Wales and cross-curricular themes for younger students. Links are provided to all the freely downloadable resources.

Science and Plants for Schools (SAPS) practical biology workshops at the Association for Science Education (ASE) Annual Conference in January 2017 allowed participants to gain first-hand experience of SAPS practical resources and discover just how reliable, affordable, relevant and engaging they are. Over two days, more than 200 delegates enjoyed the opportunity to have a go at the selection of practical investigations available in the lab, with the SAPS team on hand to support and encourage.

Providing a practical plant biology workshop in the middle of a British winter truly demonstrated how readily available plant resources are throughout the year and what an important source of living material plants are for use in school biology practical investigations.

The workshop sessions introduced the participants to SAPS practical resources that support the most recent reforms to the GCSE (General Certificate of Secondary Education usually taken at age 15/16) science



Figure 1 Conference delegates finding out more about SAPS practical resources at the SAPS practical biology workshop

and biology A-level curricula in England and Wales and to cross-science curricular themes for the 11–14 age group. As with all SAPS resources, the hands-on activities presented are tried and tested, free to download via the SAPS website, and fully supported with student instructions and worksheets, teaching and technical notes and supporting videos, animations or *PowerPoints* (see www.saps.org.uk). ‘*We love SAPS. It’s our go-to website of choice for biology practicals*’, said a workshop participant.

The practical resources presented in the drop-in sessions covered three key areas of SAPS work across the secondary curriculum:

- new GCSE science curriculum support;
- A-level practical endorsement support;
- practical resources for 11- to 14-year-olds, e.g. key stage 3 materials that explore the curriculum across chemistry, biology and physics.

The SAPS resources on plant diseases

SAPS has developed a range of engaging practical resources to support the teaching of communicable plant disease, a biological topic that is included in the new GCSE science

curriculum in England (see www.saps.org.uk/plantdisease).

The drop-in workshop provided a valuable opportunity to demonstrate that you do not have to be an expert to track down plants that are infected with plant pathogens. Living examples of easily found plant fungal pathogens were presented, such as powdery mildew, brown rot fungus and violet bramble rust living on their host plants, together with the practical teaching and learning resources developed by SAPS to engage students with this important topic (see www.saps.org.uk/secondary/teaching-resources/1360, www.saps.org.uk/secondary/teaching-resources/1361, www.saps.org.uk/secondary/teaching-resources/1359).

The poster ‘The never-ending battle for Fortress Plant’, developed by the SAPS team and Alistair Moore of the University of York Science Education Group, was also available for participants to take back to their schools. This poster introduces the array of defences used by plants to protect themselves against plant pathogens and is accompanied by a clear and understandable presentation and activity sheet for use in the classroom (see www.saps.org.uk/secondary/teaching-resources/1394).

The availability of living plant pathogen specimens, together with the teaching resources that allow students to discover more about them, reassured many delegates who are teaching this topic for the first time. ‘*It’s so helpful, so meaningful*’ one participant said.

Resources supporting the A-level biology set practicals

Trying out the SAPS practical resources that support the A-level biology practical endorsement in England (CPAC) proved to be very popular (see www.saps.org.uk/ks5).

Lively discussion and great enthusiasm accompanied the opportunity to make some immobilised algal balls and use them, together with a colorimeter, to measure the rate of photosynthesis. Algal balls are jelly-like balls made of sodium alginate in which green photosynthetic living algae are trapped and effectively immobilised. They are used because algae are tiny and are difficult to work with directly in the water; once immobilised they can be used as a photosynthetic ‘units’ (see www.saps.org.uk/secondary/teaching-resources/1354).



Figure 2 A delegate discovers more about the SAPS plant disease practical resources



Figure 3 Making immobilised algal balls at the workshop – always a delight!

The first 50 delegates to attend the workshops each day were given a SAPS simple potometer kit to take back to their schools. This cheap, easily constructed potometer allows students to measure quickly and easily the rate of water uptake (and hence transpiration) by plants using apparatus that they have set up themselves, thus adding to the learning value of this particular teaching resource (see ‘A-level set practicals – using a potometer’: www.saps.org.uk/secondary/teaching-resources/1341). The simplicity and reliability of this resource was appreciated by those teachers and technicians who had previously worked with leaky, unwieldy potometers, or who had not used a potometer before. One delegate told us that ‘*the SAPS potometer has revolutionised my teaching*’.

The preparation and observation of cells undergoing mitosis in a root tip is one of the 12 practical investigations that students studying A-level biology 2015 specifications for England are required to complete. SAPS presented their



Figure 4 Discussing how immobilised algal balls can be used in the science curriculum

modified protocol, which allowed workshop participants to produce well-stained, garlic root-tip squashes, containing clearly visible cells in different stages of mitosis, in less than 30 minutes (see www.saps.org.uk/secondary/teaching-resources/1358).

Other practical resources from the SAPS A-level set practical suite were available for



Figure 5 Making and using the SAPS simple potometer

delegates to try, including dissection and microscopy of a plant stem (see www.saps.org.uk/secondary/teaching-resources/1325), thin-layer chromatography of plant photosynthetic pigments (see www.saps.org.uk/secondary/teaching-resources/1347) and dissection and scientific drawing (see www.saps.org.uk/secondary/teaching-resources/1357). Comments from the delegates reinforced the value of such opportunities to gain first-hand experience of these practical plant biology resources. *‘Thank you. I’ve really enjoyed the practicals on offer and have benefited from the chance to try them out’* said one workshop participant.

Resources for key topics for 11–14s

The workshops also highlighted the value of plant biology to the teaching of cross-curricular themes in the 11–14 science curriculum. A selection of resources that use plant evolution and adaptation to cover key topics in biology, physics and chemistry were available for delegates to try out (see www.saps.org.uk/ks3). The resources aim to use plant-based activities to spark curiosity and interest and to engage students in topics.

Success of the workshops

As well as being relevant, affordable, reliable and engaging, SAPS practical resources are also versatile. The accompanying student sheets and teaching and technical notes are all available to download from the website as *Word* documents, making them easy to adapt to the needs of the age group using them. One of the aims of the workshops was to demonstrate the adaptability of SAPS practical resources to the teachers and technicians who came along to try them out. Cauliflower cloning, investigating leaf surface temperature and immobilising algae in alginate beads were showcased as examples of SAPS investigations that can be modified for inclusion at any stage of the secondary science curriculum (see www.saps.org.uk/cauliflower, www.saps.org.uk/secondary/teaching-resources/281, www.saps.org.uk/algalballs).

One teacher came along to the workshop looking for a practical activity that would engage and inspire a class of 13- and 14-year-olds. After trying out the immobilisation of algae in alginate and observing the effects of their gas exchange on bicarbonate indicator, he decided that this



Figure 6 Dissecting, staining and observing vascular tissue in celery



Figure 7 Delegates enjoying the opportunity for participation and discussion in an informal atmosphere at the SAPS practical biology workshop

investigation was the one that he would use to challenge his pupils to think scientifically.

The SAPS workshops provided an informal space where those involved in science education could be introduced to new versions of familiar practical investigations and find materials to support them as they prepared to teach new topics. What made the experience of attending the workshops so valuable, and set it apart from surfing the web, was that in an informal, practical workshop there were opportunities to discuss the resources on show with the ‘experts’, to share common experiences with colleagues and

to roll up your sleeves and try out the practical techniques yourself. The engaging and reliable practical resources that are freely available on the SAPS website are popular and well respected. However, when deciding whether a practical teaching resource really will meet all required objectives, there is no substitute for experiencing it at first hand. This was summed up by a delegate who, clearly enthused by the experience of participating in the SAPS plant biology practical workshop, finished the session with the words: *‘This is all such fun. It’s great to have the chance to have a go myself.’*

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Together with **Gail Webdell** (Faculty of Education, University of Cambridge) and **Bronwen Richards** (Cambridge University Botanic Garden), Dan and Beverley ran the practical workshops ‘Biology practicals that work’ at the Association for Science Education Annual Conference 2017.