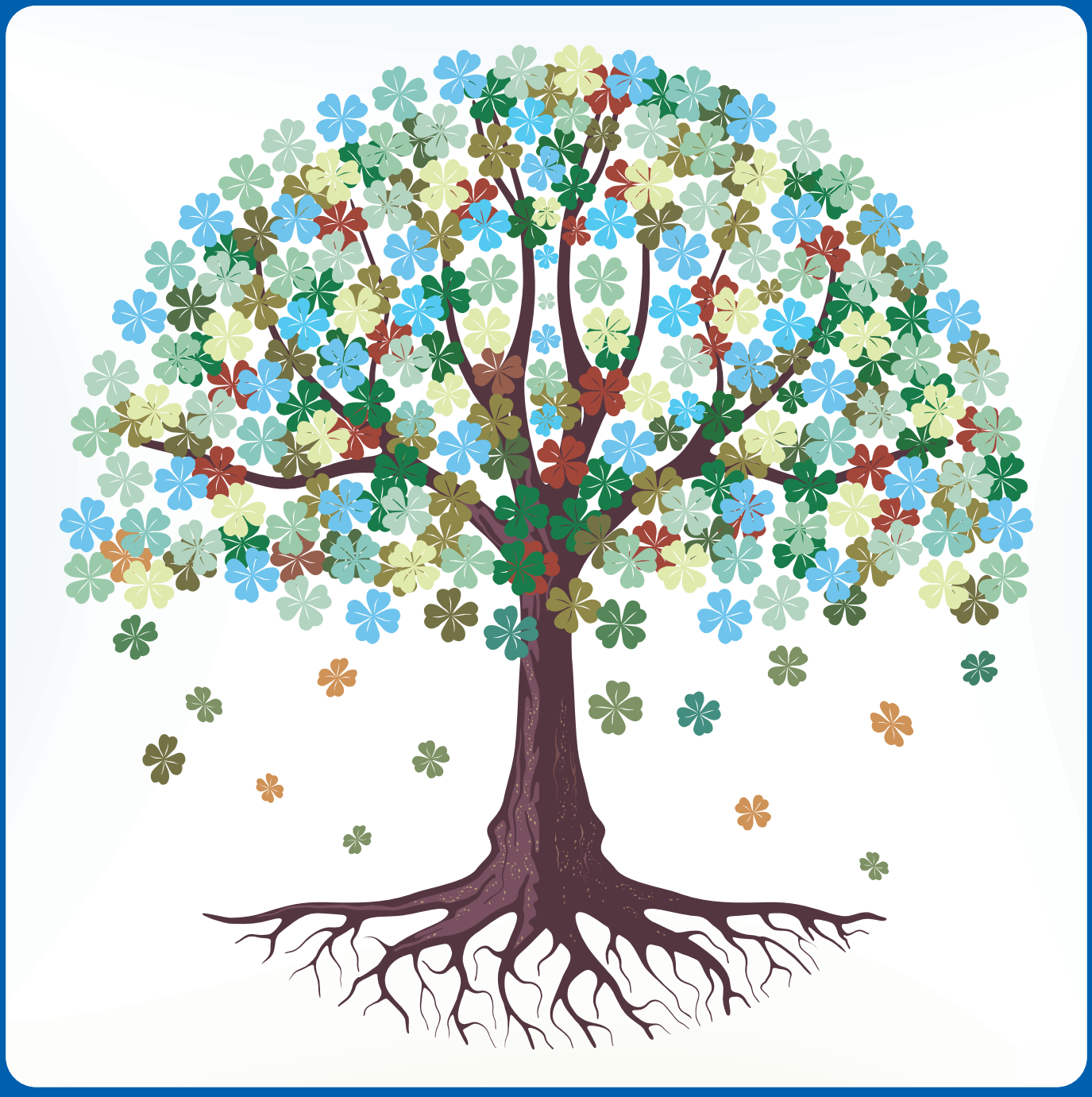
SSR in Depth

June 2022
volume 103 number 385

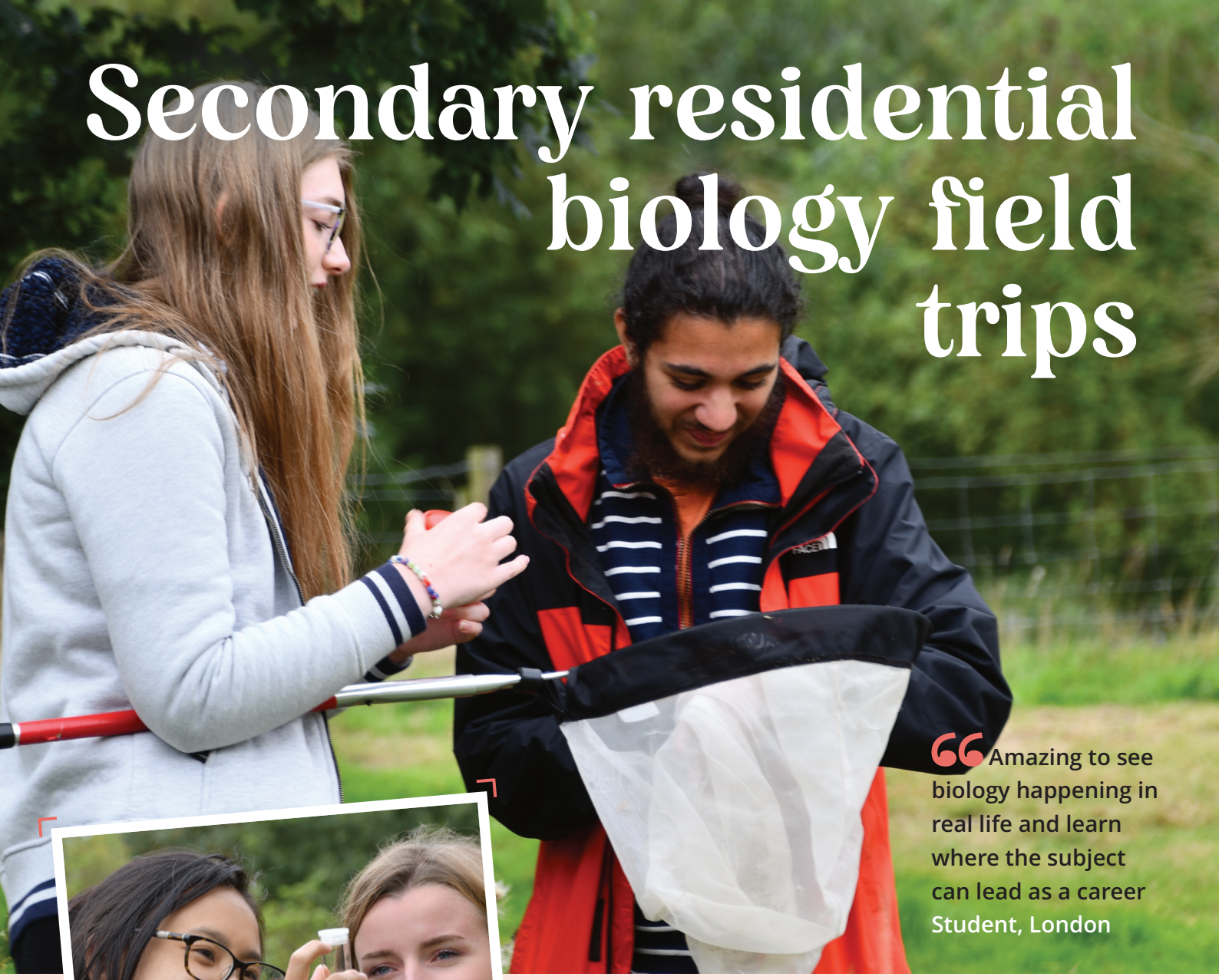
The ASE's academically reviewed journal for science education 11–19



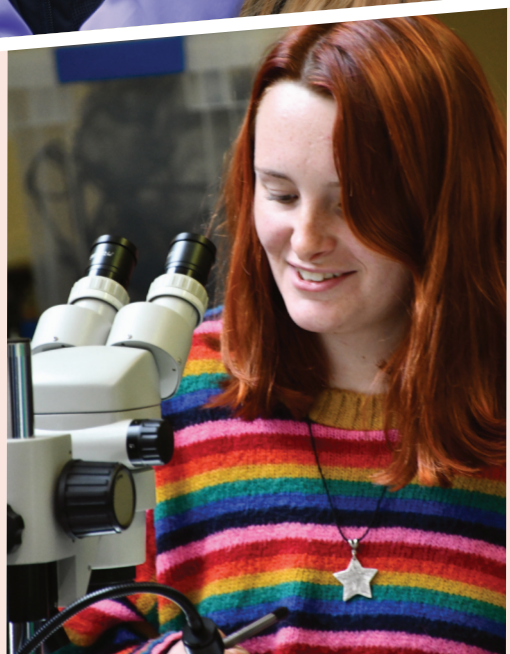
The Association for Science Education
Promoting Excellence in Science Teaching and Learning

School Science Review

Secondary residential biology field trips



> Amazing to see biology happening in real life and learn where the subject can lead as a career
> Student, London



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Contributing to *SSR in Depth*

We welcome contributions for all sections of *SSR in Depth*. For reference, a full page of A4 text in the journal is about 800–850 words; including two small figures on a page would bring that down to about 600 words. Articles should be no longer than 4000 words in total, including references.

These can be emailed to The Co-editor, ssreditor@ase.org.uk, or posted to The Co-editor, *SSR in Depth*, ASE, College Lane, Hatfield, Herts AL10 9AA. Detailed advice on the submission of articles and Science notes is available on the ASE website at: www.ase.org.uk/submission-guidelines.

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The Association for Science Education

Address College Lane, Hatfield, Herts AL10 9AA
Telephone 01707 283000
Email info@ase.org.uk
Website www.ase.org.uk

Advertising Rebecca Dixon-Watmough, rebecca@ase.org.uk

Editorial Board and Associates

Health & Safety

For all practical procedures described in *SSR in Depth*, we have attempted to ensure that:

- the requirements of UK health & safety law are observed;
- all recognised hazards have been identified;
- appropriate precautions are suggested;
- where possible procedures are in accordance with commonly adopted model risk assessments;
- if a special risk assessment is likely to be necessary, this is highlighted.

However, errors and omissions can be made, and employers may have adopted different standards. Therefore, before any practical activity, teachers and technicians should always check their employer's risk assessment. Any local rules issued by their employer must be obeyed, whatever is recommended in *SSR in Depth*.

Unless the context dictates otherwise it is assumed that:

- practical work is conducted in a properly equipped laboratory;
- any mains-operated and other equipment is properly maintained;
- any fume cupboard operates at least to the standard of CLEAPSS Guide G9;
- care is taken with normal laboratory operations such as heating substances or handling heavy objects;
- eye protection is worn whenever there is any recognised risk to the eyes;
- good laboratory practice is observed when chemicals or living organisms are handled;
- fieldwork takes account of any guidelines issued by the employer;
- pupils are taught safe techniques for such activities as heating chemicals or smelling them, and for handling microorganisms.

Readers requiring further guidance are referred to:

Safeguards in the School Laboratory, 12th edn, ASE, 2020.
Be Safe! Health and Safety in School Science and Technology for Teachers of 3- to 12-year-olds, 4th edn, ASE, 2011.
Topics in Safety, ASE, latest version on the ASE website: www.ase.org.uk/resources/topics-in-safety (login required).
Hazcards, CLEAPSS, latest version, and other relevant publications, on the CLEAPSS website: www.cleapss.org.uk (almost all schools, colleges and teacher training establishments in the UK outside Scotland are members, as are many overseas).
Hazardous chemicals database, SSERC, latest version on the SSERC website: www.sserc.org.uk/health-safety/chemistry-health-safety/hazchem_database-2/ (schools, colleges and teacher training establishments in Scotland).
Preparing Risk Assessments for Chemistry Project Work in Schools & Colleges, SSERC, 2020.

Editorial

To ensure that ASE continues to provide all members, especially those in schools, with useful, focused and targeted support, we have changed to a new two-part format for *SSR*. There is now a practitioner-specific journal, *SSR in Practice*, published in both hard copy and online form and comprising commissioned articles from teachers, ASE groups and others, and, published simultaneously, the online journal *SSR in Depth*, which you are reading now. *SSR in Depth* aims to feature more detailed, in-depth science, pedagogical and research content, sometimes generated by ASE groups, sometimes commissioned, and sometimes contributed by individual members and others.

Education for ages 11–19 in England is structured in a way that requires students to learn facts, and the performance of teachers is judged according to how well their students remember and recall those facts. This leads us to question how memory works. The memory is a store for experience and facts, but what is important is how well we can recall those facts and experiences when needed. Do we attempt to keep a record of all that happens every day, and can we discard details we feel are irrelevant? Being able to find what is needed when asked (such as 'where did I put my keys?') is important in many aspects of daily life but has a special relevance to school examinations. Students' success and, by default, the performance of their teachers, is judged through examinations. The first article in this issue, from Kendra McMahon, explores the need for trainee teachers to be open to learning from current research into neuroscience and cognitive psychology but to approach it with a critical mind.

Holding a random store of facts is of course not enough. The store has to be organised or odd items soon get lost. Many details are not worth keeping. Also, many problems require a selection of facts. The skills needed to assemble those facts, for ease of recollection and use, come more naturally to some people than others. However, the development of understanding knowledge and being able to use it to address new problems is essential for progress. Structured teaching helps students to assemble knowledge. This has to come from teachers but, as Fullick and Moore explain in the second article, it helps if the whole biology curriculum is assembled in this way. Their findings are applicable to all subjects, not just biology.

Continuing along the same lines, Christian Moore-Anderson notes the limitations of the short-answer and quick-to-mark questions commonly used for assessment, and provides two simple frameworks for longer-answer assessments in biology that require students to think deeply about biological systems and to integrate different aspects of biology so they come to understand how to learn better.

For over two years, we have had to manage our lives while attempting to avoid COVID-19. The first time we featured some of the consequences in our pages, I indicated with a quick mathematical calculation how social distancing of 2 metres should in theory lead to a very large dilution of someone else's exhaled air, making the chance of catching the virus almost negligible. Rola Khishfe covers this in more depth using a practical activity. This will help the development of many useful techniques in chemistry lessons and with students' scientific literacy.

If we are to teach students successfully, it helps if we can inspire them. Effective education must encourage students to want to learn, rather than being forced to learn. Stephen Rowcliffe reminds us that the COVID-19 pandemic meant education for many students moved to online home learning for many weeks, changing the role of the teacher. Years ago, students would learn through books, teachers and (in science subjects) undertaking practical work. But in the last 40 years or so, access to knowledge via the internet has become well established. However, not all students will be self-motivated to seek knowledge or understanding. Hence the teacher has to find ways to set the agenda, which will help necessary information to be acquired and move education forwards.

Finally we have an article by Keith Chappell, Arif Mahmud and Paul Hopkins, supported by Berry Billingsley and colleagues. They describe a project designed to test the purpose and value of practical work that provided flexible and engaging resources for exploring the 'big questions' of science.

Geoff Auty
Co-editor, *SSR in Depth*