



Responding to coronavirus

FSC A level biology fieldwork



www.field-studies-council.org/alevelbiology

Up to **5** named practicals ticked off*

All **5** practical endorsement criteria assessed

3 stats tests taught

3 different ecosystems studied

36 hours of teaching

Just **5** days off the school timetable

FSC

Editor **Geoff Auty**

Joint Executive Editors Martin Payne and Andrew Welsh

Assistant Executive Editor Helen Johnson

Book Reviews Miriam Chaplin

App Reviews Susan Judge

Websearch David S. Moore

Editorial contact ASE Jane Hanrott

Design/typesetting Andrew Welsh

School Science Review is published in March, June, September and December and sent to all Ordinary Members of the ASE free of charge. It is also available on subscription from the ASE.

Authorisation is granted by the Association for Science Education for items from *SSR* to be photocopied for personal use or for the use of specific students. Permission is needed to copy or reproduce for any other purpose and requests should be addressed to the ASE.

The contents of this journal do not necessarily represent the views or policies of the ASE, except where explicitly identified as such.

© Association for Science Education, 2020

ISSN 0036–6811

The Association for Science Education

Address College Lane, Hatfield, Herts AL10 9AA

Telephone 01707 283000

Fax 01707 266532

Email info@ase.org.uk

Website www.ase.org.uk

Advertising Rebecca Dixon-Watmough 01254 247764, rebecca@ase.org.uk

Printing Holbrooks Printers Ltd, Portsmouth, England

Contents

School Science Review June 2020, 101(377)

- 5 Editorial
- 6 Letter
- 7 Responding to coronavirus (COVID-19) in public and within education
 - 7 Observing social distancing and social behaviour *Geoff Auty*
 - 9 Physics demonstrations for observation *Keith Gibbs*
 - 10 Practical ways to illustrate some science topics at home *Beth Taylor*
- 14 Science notes
 - 14 Four more demonstration experiments *Randal Henly*
 - 17 Beautiful rings of light formed by reflection *Iain MacInnes*
 - 18 Taking photographs of the 'beautiful rings of light' *Geoff Auty*
 - 20 Toys that can foster engagement and improve understanding *Catherine Dunn*
 - 25 Helpdesk – Doppler shift in light: help needed *Tim Tranquada*
- 27 The case for including epigenetics in the school science curriculum and trainee science teachers' views about its implications for society
Marcus Grace, Andri Christodoulou, Carys Hughes, Keith Godfrey, Willeke Rietdijk and Janice Griffiths
The rapidly growing field of epigenetics has transformed biological theory and yet many of us are unaware of its significance; should epigenetics be a part of the school science curriculum?
- 32 Introducing the epigenetic landscape into middle-years biology teaching
Neil R. Ingram
Integrating Conrad Hal Waddington's ideas into the curriculum: methods and benefits
- 37 Learning the assignment of structures to oxoacids of phosphorus through a new strategy
R. S. Sindhu and Pramila Tanwar
A plan for teaching and learning chemical structures for a group of complex compounds
- 41 How to balance the equations of chemical reactions
Marten J. ten Hoor
Structuring the mathematics of calculating the correct proportions of substances to use for chemical reactions
- 45 How heavy is your pet dinosaur?
Mark David Walker
Estimating the mass of a full-sized dinosaur using a replica model
- 50 The nuclear legacy: dealing with waste and decommissioning
Frank Harris
Managing radioactive waste on a national scale
- 56 Breaking a rod: combining impulse and inertia
Nuri Balta
A method of demonstrating the unexpected effect of rapid collision with a large mass
- 58 Science teachers' lack of understanding of the nature of science: does it matter? Part 1
Stuart Farmer
Considering the distinction between a law and a hypothesis
- 64 Increasing student completion of long-form questions using bullet-point prompts
Elizabeth C. Davis-Berg and Julie Minbirole
Completion rates for long-form question with and without bullet-point prompts are compared
- 67 Understanding gaps in teacher interpretation of formative assessment evidence
Garima Bansal
Problems in planning and implementation of a formative assessment task may result in loss of its learning potential
- 73 'Don't know much about a science book': do children and young teens read science books for pleasure?
Ruth Jarman and Joy Alexander
A report on a study that explores this issue and its implications

81	Deconstructing scientific vocabulary for low-literacy students: an action research study <i>Andy Markwick</i> Explanations of words used in science, and teaching methods to help in the development of students' vocabulary
86	Reviews
90	Science websearch
93	Index to Volume 101
96	SSR special issues
96	Advertisers index

Health & Safety

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

- 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 should always check their employer's assessment. Any local rules issued by their employer must be obeyed, whatever is recommended in *SSR*.

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;
- good laboratory practice is observed when chemicals or living organisms are handled;
- eye protection is worn whenever there is any recognised risk to the eyes;
- 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:

Hazcards (CLEAPSS, 2016 and updates)

Topics in Safety, 3rd edn (ASE, 2001); updates available at www.ase.org.uk/resources/topics-in-safety

Safeguards in the School Laboratory, 12th edn (ASE, 2020)

Preparing Risk Assessments for Chemistry Project Work in Schools & Colleges (SSERC, 2020)

SSERC hazardous chemicals database (www.sserc.org.uk/health-safety/chemistry-health-safety/hazchem_database-2/)

Be Safe! Health and Safety in School Science and Technology for Teachers of 3- to 12-Year-olds, 4th edn (ASE, 2011)

Editorial Board and Associates

Editor

Geoff Auty

Editorial Board

Miriam Chaplin science education consultant

James de Winter Universities of Cambridge and Uppsala

Susan Judge AQA examiner, Marlow

Maria Kettle University of Cambridge

Vanessa Kind Durham University

David S. Moore Oxford

Dave Pickersgill Sheffield

Michael Hal Sosabowski University of Brighton

Bernard Tedd King Edward VI High School for Girls, Birmingham

James Williams University of Sussex

Janet Williams Mayflower High School, Billericay

Editorial Associates

The Editorial Associates support the Editorial Board in advising the Editor on the suitability of submitted articles.

Damian Ainscough independent education adviser

Jeremy Airey National Science Learning Centre, York

Maria Bateson The Charter School, East Dulwich, London

Richard Boohan London

Ian Carter ecology consultant, Alderney

Stuart Farmer Robert Gordon's College, Aberdeen

Alastair Fleming Oban

Mary Frost Appleton School, Essex

Rory Geoghegan Irish Science Teachers' Association, Dublin

Keith Gibbs Schoolphysics, Taunton

Randal Henly Dublin

Jon Heywood University of Leicester

Stephen Hoskins Torquay

Sue Howarth Worcester

Michael Inglis University of Leeds

Ruth Jarman Queen's University Belfast

Ian Kinchin University of Surrey

Chris King Keele University, Keele

Ian Lancaster Cheshire

Irfan Latif DLD College, Westminster, London

Dawn Leslie Davenies School, Beaconsfield

Robin Millar University of York

Andy Newsam National Schools' Observatory, Liverpool
John Moores University

Jonathan Osborne Stanford University, California

Hilary Otter St Swithun's School, Winchester

Alan C. Pickwick Manchester

Michael J. Reiss UCL Institute of Education, London

Keith Ross Villembits, France

Sarah Sephton Brampton College, London

Dom Shibli University of Hertfordshire, Hatfield

Nicky Souter University of Strathclyde

Keith Taber University of Cambridge

Christopher Talbot St. Joseph's Institution, Singapore

Alaric Thompson Ulverston Victoria High School

Robert Toplis Wendover, Buckinghamshire

Neil Walker Westfield School, Newcastle upon Tyne

ASE Health and Safety Group Representatives

Peter Borrows science education consultant, Amersham, Buckinghamshire

Phil Bunyan Oxhill, Warwickshire

Joe Jefferies Everton, Nottinghamshire

Contributing to SSR

We welcome contributions for all sections of *School Science Review*. 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.

These can be emailed to The Editor, ssreditor@ase.org.uk, or posted to The Editor, *School Science Review*, 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/content/submission-guidelines.

This last edition of the school year appears when some children at primary level have returned to their classes as the COVID-19 infection rate in the UK declines, but it seems the 11–19 age range will not return this term other than perhaps for individual interviews or consultations.

Consequently, we have again opened with some quickly produced material in response to the coronavirus pandemic. I have provided a commentary on social distancing and behaviour that I have seen while out doing the ‘essential shopping’. This is followed by two very different contributions on home schooling: Beth Taylor from the Sheffield area shows the results of giving students practical challenges to be tried using materials that can be found at home, to simulate practical ways of developing understanding of some chemistry and biology topics. In contrast, stalwart ASE member Keith Gibbs explains how he produced physics demonstrations that just grew and grew from an initial idea. Although produced at home, these are demonstrations – essentially the sort of activities teachers would do in front of a class – intended for viewing rather than doing!

In the practical *Science notes* section, Randal Henly from Dublin follows his article in our March 2018 edition with four more physics demonstrations in which the emphasis is on making your own apparatus (although similar items can be bought).

Iain MacInnes from Glasgow shows an interesting and, at first view, surprising optical demonstration. He asked me to try the observation and produce some photographs. Some of them are illustrated with a commentary on how they were obtained. An article by Catherine Dunn from SSERC in Scotland that demonstrates physics using toys is the last item of the group that we have been featuring from the presentations at the Birmingham ASE Annual Conference in January 2019. Part 2 of this will follow in the next edition.

It is quite some time since we had a *Helpdesk* item, although it remains ‘open’ any time readers want to ask a question. Tim Tranquada illustrates that understanding the Doppler effect with sound is simple but that explanations for light seem less convincing. Do readers have ideas to share on this topic? Let’s see what other readers can offer to clarify this problem.

Beginning the larger articles, Marcus Grace leads a team from Southampton discussing epigenetics and the extent to which genetic make-up can influence educational development. Then Neil Ingram from Bristol explains the possibilities and difficulties of teaching epigenetics to the 14–16 age group – Neil had a different article in the same subject area in our December edition as a result of a presentation at the ASE conference.

R. S. Sindhu and Pramila Tanwar in India explain structures of oxoacids of phosphorus as a route to developing problem-solving abilities. Marten ten Hoor from the Netherlands illustrates the mathematics involved in balancing chemical equations for complex reactions – beyond the exam specifications but an extra challenge that can be of interest to teachers and high-level students!

Mark Walker from Sheffield illustrates the importance of using old skills (taking us back to the days of Archimedes) in developing student thinking. Then long-standing contributor Frank Harris from Yorkshire explains about the process of decommissioning nuclear power installations and the concerns it can raise. Nuri Balta from Kazakhstan offers a spectacular illustration of inertia with a demonstration that involves breaking a wooden rod placed on delicate supports.

Stuart Farmer from Scotland, another prominent ASE member, considers the education process and questions whether teachers have an adequate understanding of the nature of science.

Then, from the USA, Elizabeth Davis-Berg and Julie Minbiole suggest how to improve examination performance. Garima Bansal from India considers how to improve results in tests and examinations, bearing in mind the influence and limitations that this can have on what is taught. Considering the influence of league tables in British schooling these days, receiving two such articles from different countries indicates that we are not alone in operating within this type of background.

Ruth Jarman and Joy Alexander from Northern Ireland consider that there are plenty of science-based books in bookshops that would interest children but that few choose to read them. They discuss what could be done to try to improve the situation.

We all have to communicate using language. Andy Markwick, who is a member of the ASE Publications Committee, has produced a study of words in order to discuss the problems that children can have when scientific ideas are being explained to them, and in providing explanations themselves during examinations. I have heard children say, ‘*I understand it but I can’t explain!*’

Two observations! The diverse content of this edition means there should be something to suit most readers, while the range of countries from which articles have come suggests that ASE is appreciated around the world.

With many of these articles having been submitted some time ago, the second part of a theme on science with engineering applications that we began in March is being held over until the next edition.

Geoff Auty

Editor, *School Science Review*