# Reviews

Reviews published in *School Science Review* are the opinions of individual reviewers, and are not an official Association for Science Education (ASE) view or endorsement of the resource. Reviewers are selected to write reviews on the basis of their experience and interests. They are expected to draw attention to perceived weaknesses or limitations of a resource as well as its strengths. The reviews are written from the standpoint of someone seeing the materials for the first time and considering how they themselves would use them, or think colleagues would be likely to use them.



## AQA GCSE (9–1) Science. Required Practicals Teacher Handbook: Teacher and Technician Information

*David Johnston, Adrian Schmit and Matt Shooter*
*London: Hodder Education, 2019*
*136 pp. £80.00*
*ISBN 978 1 5104 5151 3*

## AQA GCSE (9–1) Biology. Required Practicals Lab Book: Exam Practice and Further Application

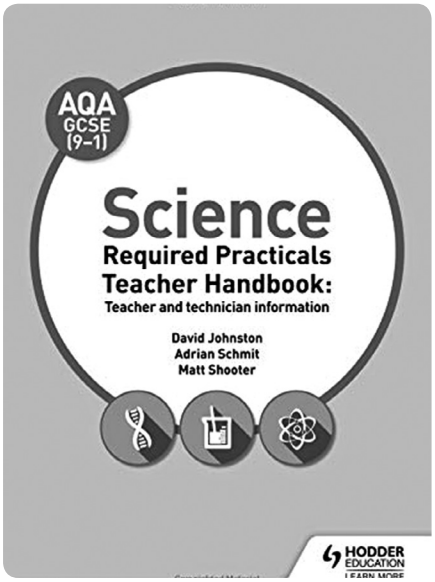
*Adrian Schmit*
*London: Hodder Education, 2019*
*72 pp. £3.99*
*ISBN 978 1 5104 5104 9*

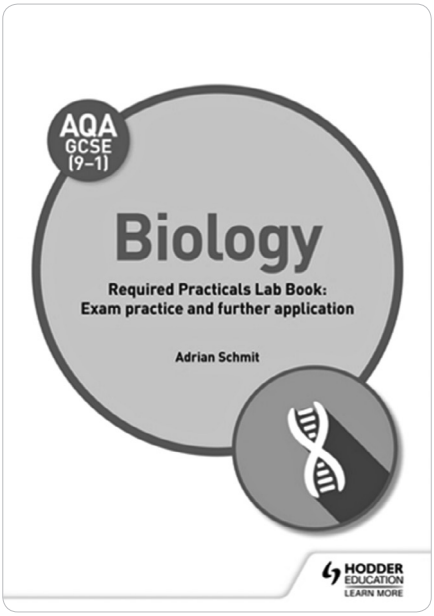
## AQA GCSE (9–1) Chemistry. Required Practicals Lab Book: Exam Practice and Further Application

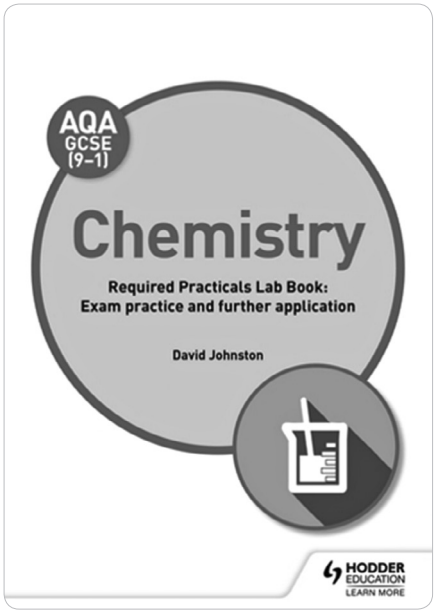
*David Johnston*
*London: Hodder Education, 2019*
*72 pp. £3.99*
*ISBN 978 1 5104 5148 3*

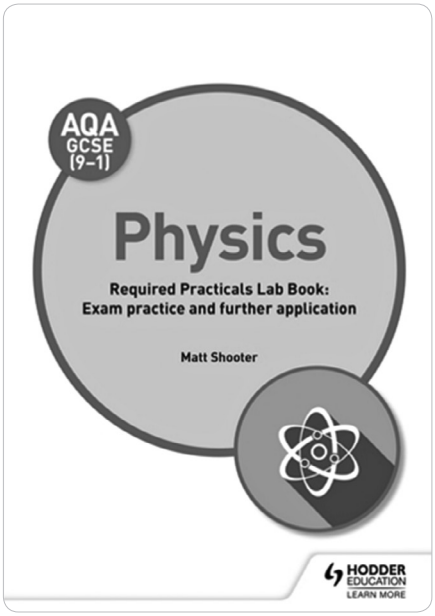
## AQA GCSE (9–1) Physics. Required Practicals Lab Book: Exam Practice and Further Application

*Matt Shooter*
*London: Hodder Education, 2019*
*72 pp. £3.99*
*ISBN 978 1 5104 5149 0*





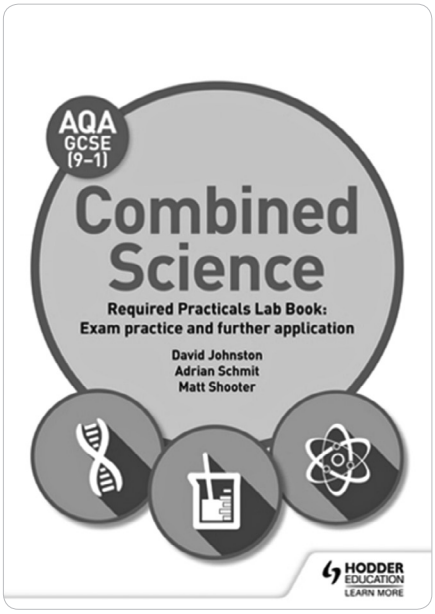

## AQA GCSE (9–1) Combined Science. Required Practicals Lab Book: Exam Practice and Further Application

*David Johnston, Adrian Schmit and Matt Shooter*
*London: Hodder Education, 2019*
*160 pp. £5.49*
*ISBN 978 1 5104 5150 6*

This suite of resources extends the range of materials already available from Hodder Education to support the AQA specifications. Like the textbooks and teacher support guides, they provide plenty of material for both pupils and teachers to use and are designed to provide a common approach to covering the required practicals across the three science disciplines, whether the final goal is separate sciences or combined science.

Professing to be the only set of such resources that includes a teacher book, the comprehensive teacher and technician guide provides mapping grids for the different specifications, links mathematical skills to each practical and contains checklists for 'working scientifically' skills. With equipment lists and safety notes, ordering the experiments and preparing risk assessments is made easy, and sets of expected results with possible reasons for unexpected results allow even the most inexperienced teachers/non-specialist teachers to deliver the experiments effectively. Furthermore, there are suggestions for possible alternatives, extension ideas and lists of linked experiments to enable the required experiment to be placed in an appropriate context. Finally, answers to the written questions in the pupil books are also provided. All in all, this is a very wide-ranging support manual that could very usefully have a place on the bookshelves of any science department.

The pupil books (single-life workbooks) are, in my opinion, an acquired taste! Firstly, we all know the irritations of looking for suitable exam questions to set our pupils, only to find that there are one or two parts of the question we haven't covered yet, thus rendering the question in its unedited form of limited use, if not useless. These books have the potential to have the same limitations. Providing a set of practicals with a range of follow-up questions, including further application of the principles involved, necessarily assumes a certain teaching order and thus may not suit your scheme of work. I am not very familiar with the linked textbooks and thus cannot comment further as to the detail




of how they dovetail with these resources. Secondly, there is a philosophical question to ask as to whether a separate book for all practical work is the best way for pupils to see experimental work fully integrated into their learning.

However, limitations aside, looking more closely at the presentation and content of the individual practicals, the methods are detailed and presented clearly with easy to follow instructions. A variety of notes, tips, key terms and equations and safety information are provided in boxes and clear diagrams are included where appropriate. Tables are provided for results. There are a lot of words on each page of instructions,

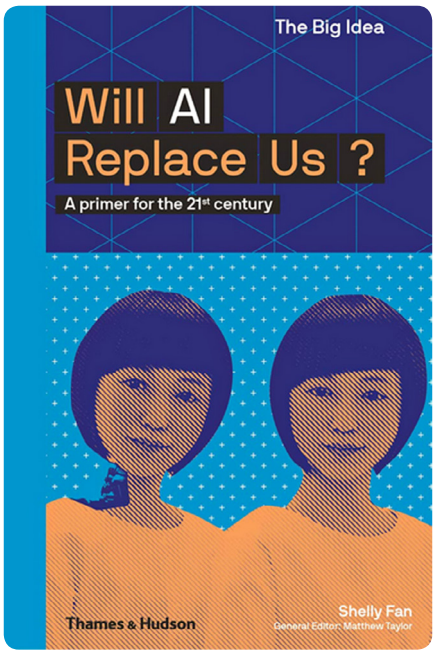
which could be overwhelming for some. Follow-up questions are detailed and provide a good range of challenge for different abilities. Exam-style questions and questions to develop skills of application are also included. Each experiment is also linked by page references to the pupil textbooks. The combined science lab book takes each of the required practicals from the separate science lab books, provides information to link them to both the trilogy and synergy specifications and also links each to the combined science textbooks.

I would expect departments to have their own ways of doing these ubiquitous experiments and thus a judgement as to the value of using the books as a whole would depend on the perceived benefits to pupil learning, the convenience of such an approach, and the cost. They are definitely worth consideration, but I would recommend a detailed look at the individual exercises before reaching a conclusion.

*Janet Mitchell*

## Will AI Replace Us? A Primer for the 21st Century

*Shelly Fan*
*London: Thames & Hudson, 2019*
*144 pp. £12.95*
*ISBN 978 0 500 29457 4*

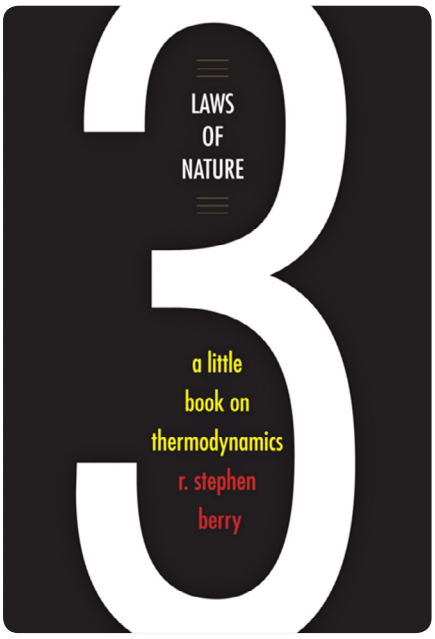



This book is about artificial intelligence and is in The Big Idea series edited by Matthew Taylor, Chief Executive of the RSA in the UK. The author is a neuroscientist at the University of California.

One can read this book '*in the way that suits you best. Paragraphs are prioritised using different font sizes. The larger the font size the more important the words are to the overall concept or argument*' (this is known as quick-recognition text hierarchy). It should take about half an hour to read the paragraphs in the two largest font sizes and '*you'll still get a basic overview of the subject*', and about two hours to read the whole book. The introduction ends with a question (in the largest font size): '*Is it a human vs. AI destiny, or a human plus AI future?*' The rest of the text is devoted to answering the question. The history of AI is reviewed, as are the capabilities, limitations, problems and future of AI. The final two sentences of the conclusion provide the answer to the question posed at the end of the introduction (in the largest font size): '*Under open and intelligent discourse, AI will not replace us. Rather, it will profoundly transform humanity for the better*'.

The text is well illustrated, with the terms used explained in definitions alongside them. There is an extensive further reading section and a useful index. This is a readable book and could be a useful adjunct to more formal course texts, for example, for additional reading in the senior secondary school, sixth-form colleges, further education colleges, and first-year university courses. Get a copy for the library.

*J. Keri Davies*




## Three Laws of Nature: A Little Book on Thermodynamics

*R. Stephen Berry*
*London: Yale University Press, 2019*
*168 pp. £16.99*
*ISBN 978 0 300 23878 5*

Given that thermodynamics underpins physics teaching, its presence in school physics is often more implicit than explicit, for example in teaching specific heat or the gas laws, or partial, for example the first law being covered in WJEC physics. Classical thermodynamics features heavily in only one A-level physics topic, AQA's Engineering Physics, and even then it is only as an optional topic. So students could leave the sixth form officially well qualified in physics, but fail C. P. Snow's litmus test on the second law of thermodynamics and thus end up on the 'wrong' side of the 'Two Cultures' divide going back 60 years. While those were indeed different times, Berry reminds us of Einstein saying '*thermodynamics is the science most likely to be true*'.

Berry covers the birth of thermodynamics, from the most decidedly applied nature of improving steam engines in the British Industrial Revolution era to a pure science detailing idealised systems in equilibrium. This

evolution is contrasted with the usual scientific paradigm of the last two centuries, whereby applied science almost inexorably follows on from the pure.

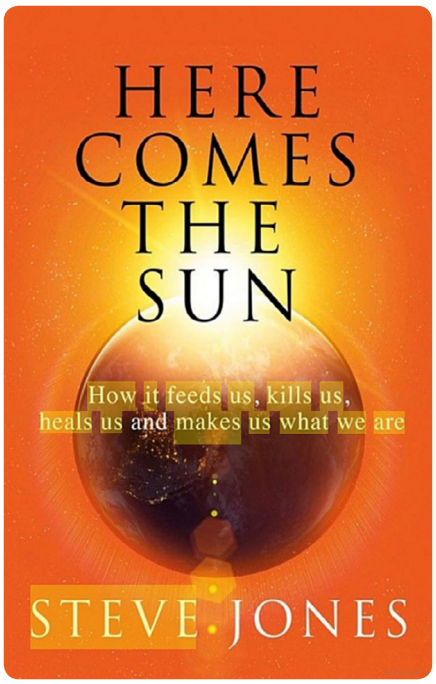
After two chapters on the first law, and second and third laws ('*Why we can't go back in time*'), Berry moves on to challenges like the difficulties of applying classical thermodynamics to very small systems, that is, of assemblages of up to around 80-ish particles. Entropy is a numbers game: considering the probabilistic nature of chancing upon a system at an instant when the system is a significant deviation away from the most probable state given the macroscopic conditions. There is also discussion on the argument that if the laws of thermodynamics are inviolate then dark energy must surely bow down before them too.

Berry finishes with a chapter called '*What can thermodynamics teach us about science?*' We have the benefit of embedded 'how science works' here, but a particularly interesting question is thrown out for us to ponder: '*Is energy a discovery or an invention of the human mind?*'

The primary readership is American, so there is a degree of transatlantic parochialism: for example, the calorie appearing in units and temperature scale consideration beginning with Fahrenheit; also teachers of a certain age could feel like they have gone back in time when they encounter mention of ethyl alcohol.

That minor criticism notwithstanding, as a teacher, I appreciated the chance for a refresher course, to know my Otto from my Carnot, and I can recommend the book as a useful read for A-level physics teachers, particularly if any of your students choose that 'old school' A-level engineering physics option.

*Ian Francis*




### Here Comes the Sun: How it Feeds Us, Kills Us, Heals Us and Makes Us What We Are

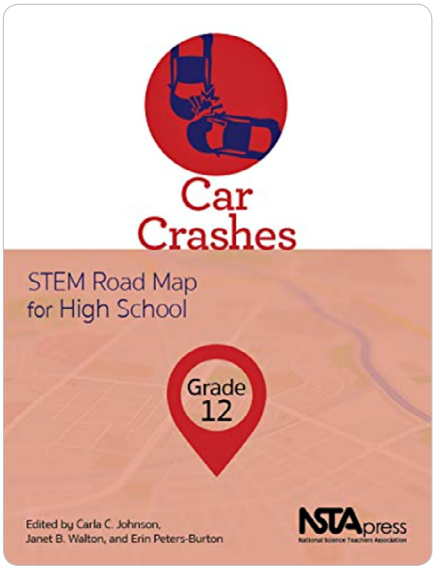
*Steve Jones*
*London: Little, Brown, 2019*
*360 pp. £20.00*
*ISBN 978 1 4087 1131 6*

This book is by Professor Steve Jones FRS, who will be known to many readers as a writer and broadcaster of the highest calibre; he has produced another winning publication. This is a highly readable book, the content of which is signalled by the subtitle. The argument developed demonstrates how planet Earth is ruled by the Sun. Throughout the text, Jones weaves in his research work on snails and the fruit fly, all of which enriches the reader's experience.

The preface is a long one – 33 pages – and is well worth reading. It is highly personal but blends in well with the story being told in the main text. It sets the scene well for what is to come. The story he tells is an exciting one, as he draws upon biology, physics, chemistry, medicine, history, geography, geology, astronomy, politics, and more, to develop his themes in relation to the Sun.

This book is a true synthesis of relevant knowledge. Anyone interested in the role of the Sun in our lives will/should be interested in this text. It is written by someone who knows and cares about what he writes. Well done Professor Jones: you have produced a most timely book and a major contribution to the current discussions on the environment and global warming – and much more besides. There should be a copy of this book in every secondary school, further education college and university library – with the encouragement that it should be read.

*J. Keri Davies*




### Car Crashes: STEM Road Map for High School, Grade 12

*Ed. Carla C. Johnson, Janet B. Walton and Erin Peters-Burton*
*Arlington, VA: NSTA Press, 2018*
*138 pp. £27.50*
*ISBN 978 1 68140 546 9*

This is a book in the STEM Road Map Curriculum Series published by the National Science Teachers Association (NSTA) of the USA, a similar organisation to the ASE. The series is informed by the Next Generation Science standards, the Common Core State Standards and the Framework for 21st Century Learning. All of these initiatives seek to repurpose education and teaching for the perceived challenges of the 21st century. An appendix to the book details all the

standards mentioned above. The book is targeted at grade 12, which is the 17–18 age range and hence equivalent to A-level, Scottish Highers or BTEC applied science.

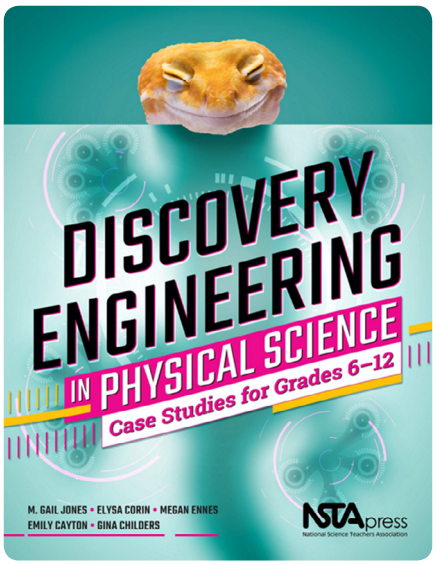
Part one of the book deals in some detail with the thinking behind the STEM Road Map Curriculum Series and the pedagogy of an integrated STEM approach using a self-regulated learning theory approach. In support of their choice of learning model, the authors provide a detailed well-referenced academic discussion of different learning approaches.

Part two of the book describes the actual Car Crashes module and includes a scheme of work, lesson plans, teaching activities, assessment plans and internet resource references. The module is based on three themes: technological advances in automobiles, reconstructing collisions, and crash forensics.

The content is mainly physics – velocity, acceleration, momentum (1D and 2D), collisions and so on – combined with a consideration of the engineering side of improving car safety. The module is made broader by asking students to consider issues concerning their rights as a citizen, in particular the tension between government rules and personal freedom. The area focused on is the wearing of seat belts, which we in the UK now take for granted. It would not be difficult to generate more suitable UK-based ideas for students to think about, such as should there be such a thing as personal car ownership?

The big issue with this book is that it is rooted in the American experience as well as a particular curriculum project approach. It is also fairly expensive. However, it does have some useful sections and some interesting ideas.

*Alex Chaplin*




## Discovery Engineering in Physical Science: Case Studies for Grades 6–12

*M. Gail Jones, Elysa Corin, Megan Ennes, Emily Cayton and Gina Chiders*
*Arlington, VA: NSTA Press, 2019*
*297 pp. £43.50*
*ISBN 978 1 68140 617 6*

Don't turn away: this is not a book 'about engineering'! The transatlantic title and the £40+ price tag does it no favours for a British market, but this is a book *for science teachers by science teachers* – and it is well worth a look!

This is a volume of 22 exploratory activities (think STEM club, or a lesson with a bit of breathing space), each one set within a context and each one leading to a design problem – hence the words 'discovery engineering'. It is a product of the ASE's counterpart organisation in the USA – the National Science Teachers' Association – and it is a resource that has been thoroughly trialled and tested for classroom use. Everything the teacher requires is here, from lesson plans to worksheets, lists of lab requirements, health and safety information, answers to student questions, and even a marking scheme for assessing the design problems. Each activity is set around a 'case study' – a short account, often historical, of the way a technical development has arisen. There is an emphasis on innovations that have come from chance observations, and students are challenged to use their own creativity to design new products or solve problems.

There are some familiar stories here, such as the invention of Velcro from close examination of plant burrs, but did you know there is a berry that is iridescent for the same reasons as a butterfly's wing or a patch of oil on a puddle (the marble berry, *Pollia condensata*, if you're interested)?

Some cases are written up better than others: Harry Brearley's accidental (or perhaps 'incidental') discovery of stainless steel is interestingly explained, whereas the corresponding piece on superglue is rather dull and unclear. Overall, however, this is a really good resource – and the price includes limited photocopying rights, so you only need a single copy. Warmly recommended as a fresh approach to science teaching and learning – whether in a classroom or a more informal setting.

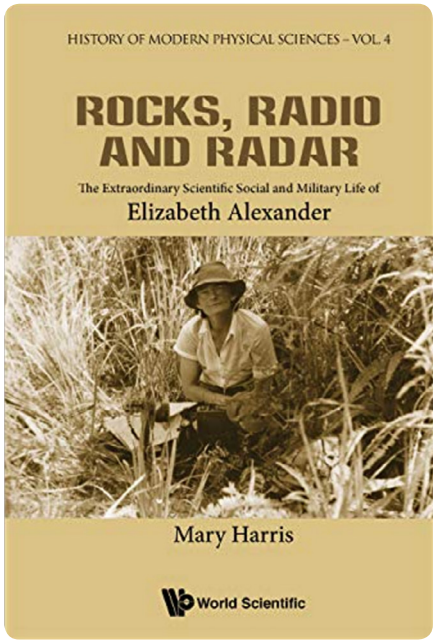
*Colin Johnson*

## Rocks Radio and Radar: The Extraordinary Scientific, Social and Military Life of Elizabeth Alexander

*Mary Harris*
*London: World Scientific Publishing Europe, 2019*
*616 pp. £75.00*
*ISBN 978 1 78634 664 3*

This book is a biography of Elizabeth Alexander (1908–1958), a scientist whose achievements include significant contributions to geology and to the beginnings of radio astronomy and radio meteorology. Despite the significance of her work, relatively few people know about her.

One of the reasons that her work is not more widely known about is that during the Second World War she was Head of the Operational Research Section of the Radio




Development Laboratory (radar) in Wellington, New Zealand. The New Zealand Government's 1948 Radar Narrative concerning wartime work on the development of radar was not declassified until 1992.

Another reason seems to have been that it was hard for a woman to gain recognition in the scientific community of the time. Her husband, Norman Alexander, shared the common prejudices against women scientists, too: the book's author (his daughter) noted that '*Norman himself remarked of Marie Curie that she only helped Pierre in his work, and of Rosalind Franklin that she only took the photographs*' and that he remarked on Dorothy Hodgkin's work that '*crystallography is a woman's game because all it needs is a lot of patience*'.

At the start of the Second World War, Elizabeth Alexander and her family were living in Singapore, where her husband was Professor of Physics at Raffles College. She was carrying out research on the island's geology, but in 1940 she also began working for the British Naval Intelligence Service on radio direction finding (RDF), which was another name for radar. In 1942, she and her three children were evacuated to New Zealand where Norman's family lived. The description of the family's journey to Australia by Sunderland Flying Boat is contrasted with that of an earlier journey made by Elizabeth by flying boat under very different circumstances. The evacuation was accomplished in a series of relatively short but perilous stages and involved considerable planning for the practicalities of accommodation on the stops between flights. Norman remained in Singapore, and the chapter '*Singapore: disaster, death and survival*' is about what happened to him and others during and following the fall of Singapore. Norman survived internment by the Japanese and the family were eventually reunited.

For me, some of the most interesting aspects of the book are the insights into a particular social context, whether it is scientific society in 19th century London, the Cavendish Laboratory in the 1930s, colonial life in pre-war Singapore, or the student and academic community at the newly established University of Ibadan, Nigeria, in the 1950s. However, in an effort to show the full context of Elizabeth Alexander's achievements and difficulties there is a lot of detail: I occasionally found myself thinking that this was all very interesting but where was Elizabeth Alexander at this point? As I read, I was particularly frustrated by the attention given in an early chapter to Mary Somerville and her husband in the 1820s, and in later chapters to Norman Alexander's work and experiences. However, these frustrations were to an extent mitigated in the final chapter, '*A disappearance from history*', which explores the reasons for Elizabeth Alexander's 'disappearance from history' and, among other things, revisits the proposition that the difficulties experienced by Mary Somerville in gaining recognition for her work as a scientist in the 19th century were still being experienced over a hundred years later. At the same time, Elizabeth's own personality and behaviour contributed to the 'disappearance', as she not only put her husband's needs first, but was also prone to compare her work and contributions unfavourably to those of her husband.

At over 500 pages, with references at the end of every chapter, this is also quite clearly a reference book intended for an academic library. It is actually Volume 4 of a series, *History of Modern Physical Sciences*, which is intended to be '*useful to scientists, graduate students and anyone else with a serious interest in the history, philosophy and social studies of science*'. It is a pity that the very high cost will probably put off most individuals or school science departments from purchasing the book, and thus it will not help to bring an appreciation of Alexander's achievements to a wider audience.

*Miriam Chaplin*

## Reviewers

**Alex Chaplin** is a former Head of Science and taught science in London schools for over 20 years. He currently works in an FE college.

**Miriam Chaplin** is a STEM education writer, editor and teacher trainer.

**J. Keri Davies** is an independent consultant in higher education.

**Ian Francis** is a physics teacher and examiner.

**Colin Johnson** is a senior visiting research fellow in the School of Education, Bristol University. He taught for 24 years in schools and universities, and has since worked extensively in science centres and museums.

**Janet Mitchell** teaches chemistry in south-west London.