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.

Biology for Open Minds

Ianto Stevens

York: Ianto Hugh Stevens/YPD Books, 2018

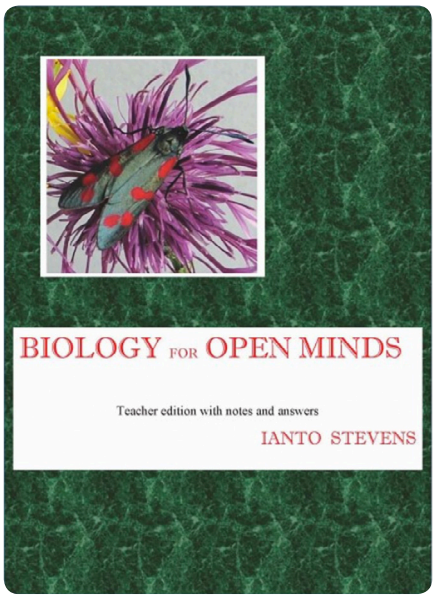
Teacher edition with notes and answers

272 pp. £25.00
ISBN 978 1 9998290 3 2 (Kindle), 978 1 9998290 2 5 (ePub)

Student's working edition

163 pp. £6.00
ISBN 978 1 9998290 1 8 (Kindle), 978 1 9998290 0 1 (ePub)

Biology for Open Minds is an eBook consisting of a collection of 20 A-level study guides covering topics chosen for their importance for society and, sometimes, for their controversy. Written by an experienced teacher of A-level biology and former principal examiner, the book covers biochemistry, ecology, plant biology, mammalian physiology, genetics and evolution. It is illustrated with



photographs, micrographs and diagrams. The teachers' edition includes teacher notes with extra detail as well as useful content summaries and suggested answers to questions. The student edition just has the study guides. YPS (www.yps-publishing.co.uk) will supply a school or college with an intranet-compatible version of the student book for indefinite internal use within the institution at a cost of £45.00.

In each guide, short bursts of text are punctuated by questions that help engage pupils. The guides are independent of each other and can be used in any order, either before or after studying a topic. The writing is lively and accessible and draws the reader in. It aims to get pupils thinking like biologists, encouraging them to consider the bigger picture, apply knowledge from different areas to the question under discussion and develop intellectual and discussion skills.

I particularly like the liveliness and accessibility of the text, which avoids the use of unnecessary jargon while not shying away from

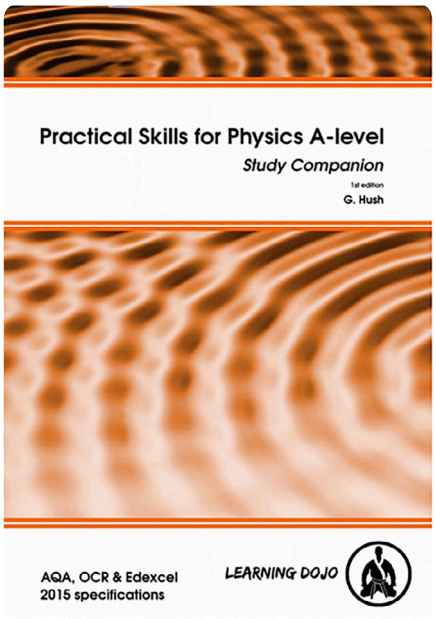
key terms. Topics are covered in a satisfying depth while remaining within the realms of A-level biology and the questions are well placed and well chosen. There are frequent opportunities to revise and recap; for example, when discussing flight pupils are asked to recap anaerobic and aerobic respiration and organelles, and this is particularly useful for the new linear qualifications. Other activities include short research tasks, such as finding out about the importance of the Park Grass experiment in improving plant yields or comparing the flight and feeding of hummingbirds and hawk moths.

There is ample opportunity for pair or class discussions and debate, including the fiendish poser of how the ancient Greeks could have been persuaded that the four elements idea does not explain the make-up of plants and whether we should be concerned about small, dull or unattractive endangered animals. 'How science works' is covered by the use of some history of science and by discussing and drawing conclusions from data, such as tables comparing oxygen consumption and body mass for different animal species or comparing crop yields for different conditions.

The book is available in ePub and Kindle formats, which makes it portable and relatively cheap. I used the Kindle format and initially found it difficult to navigate, never having used my Kindle for a textbook before. While navigation became easier with practice, I did find this format somewhat limiting, as tables could not be viewed in one screen and photographs were black and white. These problems are possibly resolved by the ePub format.

I would recommend this book for teachers of A-level biology who want to develop pupils' thinking skills and engage them in their subject. It would perhaps best be used as a source of interesting homework to revise, recap and extend pupils' knowledge before following up with discussion in class, but it could also be used for group or pair work in class, time permitting, or as extension work for individual pupils who wish to carry out some independent work before applying for university.

Sarah Wood



Practical Skills for Physics A-level: Study Companion

Gillian Hush
Leicester: Troubador, 2018
232 pp. £12.99
ISBN 978 1 789014 89 1

This book will be useful to all teachers of A-level physics who need to teach practical skills as defined by the new specifications and are worried by the prospect! The AQA, OCR and Edexcel specifications are considered in detail and the book is packed with clearly presented examples. The standard examination board practicals are also fully discussed, with sections dealing with analysing the data and errors/uncertainties.

The book is laid out over eight chapters, taking the reader from units and dimensional analysis, through uncertainty and propagating errors in calculated quantities, graphical analysis and concluding and evaluating. This last area is one that students find difficult and the 'key points' boxes in this chapter will be useful to students as they write evaluations of their experiments.

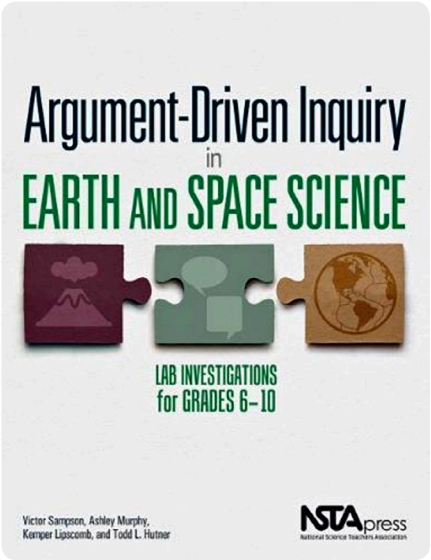
Each chapter clearly references skills identified by examination boards and key points are usefully summarised in boxes. Numerous worked examples are discussed. The teacher or pupil can work through an example and find the solution as 'inverted text' next to the problem – a nice feature that will make life easier for those engaged in independent self-study. Pupils could easily use the book to work through the material on their own. Illustrations, graphs and mathematical working are well set out and the author's claim that the book is a study companion is fully justified in my view.

The experienced physics teacher will be familiar with all the explanations and ways of presenting and discussing the concepts (the target metaphor for accuracy, precision, and so on, is in common use). The book does survey what the examination boards are asking for in this area and the collection of examples will be useful for novice and experienced teacher alike.

For teachers requiring more depth on error analysis, the National Physical Laboratory has a section on its website where guides can be downloaded after registration; also, *An Introduction to Error Analysis* by John R. Taylor (University Science Books) is a classic work on error analysis.

I will use this book with my pupils, especially those who need lots of exemplar material. I will make use of the book's clear structure to encourage my pupils to become independent and study ideas on their own. This alone justifies the purchase of a copy for any physics department.

Steve Hearn



Argument-Driven Inquiry in Earth and Space Science: Lab Investigations for Grades 6–10

Victor Sampson, Ashley Murphy, Kemper Lipscomb and Todd L. Hutner
Arlington, VA: NSTA Press, 2018

Student Lab Manual

284 pp. £20.95
ISBN 978 1 68140 598 8

Teacher book

612 pp. £45.50
ISBN 978 1 68140 373 1

These books are aimed at grades 6 to 10 (ages 11–16) in the United States, and are part of a series of books produced by the National Science Teachers Association.

The teacher book starts with a section explaining the argument-driven inquiry instructional model for practical investigations, where it explains the emphasis on 'figuring things out' instead of 'learning about things'. This is an interesting approach to investigations, requiring students to develop a guiding question to investigate, and then to look at what they believe and the evidence justifying those beliefs. This approach allows broad and open-ended questioning.

The book is then divided into five sections, such as 'History of the Earth' or 'Weather and climate'. Each section is divided into a series of 'labs', which are the investigations. Some are at an introductory level, but others are more advanced. Each lab has extensive teacher notes containing background factual material, teaching approaches, notes on equipment and safety. There is also material on how each lab relates to the American school standards. There are 23 investigations in total. Each investigation would take approximately three to five hours to complete.

Each lab also has student hand-outs, which give some of the scientific background and introduce the task, and checkout questions, which can be used in several different ways. The student hand-outs and checkout questions form the content of the *Student Lab Manual*.

The American focus of the book limits it for use elsewhere, but the overall approach would have real benefit for students. These books would be well suited to schools or colleges involved with training science teachers or those who are looking for a broader approach to their teaching.

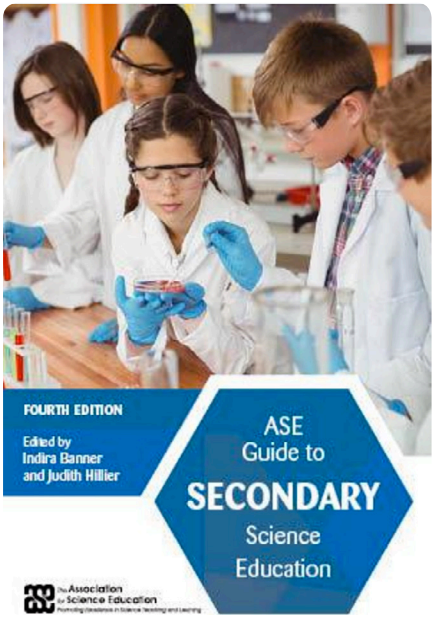
Ann Reddecliffe

ASE Guide to Secondary Science Education

4th edn. Ed. Indira Banner and Judith Hillier
Hatfield: Association for Science Education, 2018
321 pp. £50 (ASE members £25)
ISBN 978 0 86357 458 0

I began teaching nearly 20 years ago, and one of my first purchases on my PGCE course was *ASE Guide to Secondary Science Education*! It was a pleasure to review this old friend, which has served me (and most of my student teachers) well over the years. Freshly updated to encompass up-to-date pedagogy and practice, this book is a must for all science teachers old and new.

ASE Guide to Secondary Science Education covers a wide range of topics in five sections, from why we teach science (a question I am often asked by pupils) to science teaching as a profession. While the content I teach pupils has



largely remained the same over my career, the way I teach science has changed dramatically. This book provides a wealth of evidence-based information about how pupils learn science, and, more importantly, how we can introduce pupils to real-life science outside the classroom and increase their understanding of the natural world.

Some highlights of the book include sections on mathematics in science, using data, language and talk, and science and belief. As a teacher in a Church school (and several others), I found the section on science and belief extremely thought provoking.

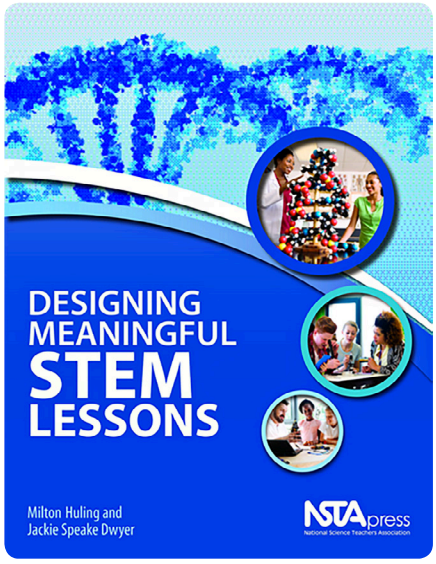
Teaching young people science is a huge, multi-faceted task that requires a special understanding of the benefits, not only to the individual learners, but to society as a whole. *ASE Guide to Secondary Science Education* should be on the shelf of every science educator!

Kate Cree

Designing Meaningful STEM Lessons

Milton Huling and Jackie Speake Dwyer
Arlington, VA: NSTA Press, 2018
199 pp. £19.69
ISBN 978 1 68140 556 8

This book is designed to correlate with the US *Framework for K–12 Science Education*. This means that some of the terminology and the



documentation referred to in the book may not be familiar to British readers. I would have found it helpful to have a table showing the meaning of some of the acronyms used, but this may be unnecessary for American readers. It is aimed at American grades 3 to 8 (ages 8–14).

The book takes you through STEM lessons as an integrated approach to learning. The authors do this through 13 lesson plans that show in detail how the material should be used and the way that questions should be framed so that the science can be integrated with and through engineering, mathematics and technology. They call this process StEMT.

I found StEMT to be an interesting approach to integrated learning. It also shows up clearly how the US approach to STEM teaching is moving in a different direction from that of the UK, where core practicals are specified and the opportunities for this sort of integration are more limited.

The 13 lesson plans cover sequences of lessons, usually five 50-minute lessons. There are resources for the lessons, identification of misconceptions and ideas for how students can move through the five Es – engage, explore, explain, elaborate and evaluate – as they develop their learning. The lesson plans are quite detailed and contain material that tries to get students to investigate problems and to develop the ability to articulate their ideas. All this is done with interesting scenarios for traditional material, for example using the zombie apocalypse to learn about cell structure and function.

This book would be useful to those who are training teachers of STEM subjects. It may be less useful to classroom teachers in Britain.

Ann Reddecliffe

Thinking Science: Questions to Provoke Thinking and Discussion

University of Bristol, 2017
43 pp. Available as a free digital download from www.bristol.ac.uk/thinkingscience or as hard copy pack free on request from thinking-science@bristol.ac.uk

Every now and again a resource appears that just makes you stop and wish that you could find more of them; this is one of those resources. To make it even better it is totally free as a digital download. The book is produced by the University of Bristol as part of their 'Thinking Science' project, which aims to promote pupils' thinking and ultimately discussion about science topics. It has been produced in a collaborative project between the University of Bristol and various schools where the topics have been trialled, refined and re-tested to ensure that they are of a quality that can be used as a pick-up-and-go resource.

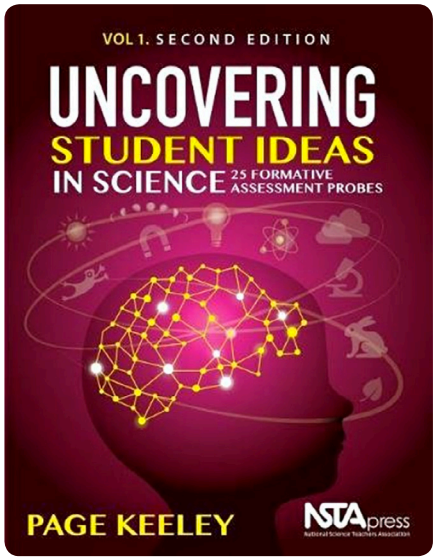
It is broken down into four sections: biology, chemistry, physics and working scientifically. In each section there is a page of pupil questions that will leave them with open-ended quandaries that automatically provoke discussion. There is a further 'Think Big' question, which asks pupils to consider the whole way in which science educators think about future developments. Then, on the back of this there is a teacher guidance page with plenty of hints on how the topic could be developed further (complete with differentiation) and links to the key stage 3 (ages11–14) curriculum.

This book is primarily aimed at the key stage 3 age range but could be used by upper key stage 2 (ages 9–11) pupils or even with weaker key stage 4 (ages14–16) pupils. This is a very good resource for starter activities to stimulate discussions at the beginning of lessons and get the pupils motivated to learn. It could also be used to develop thinking skills in pupils or simply to show how debates work in a classroom situation. The flip book is useful and well made and will not fall to bits with repeated use; what makes it even better is that it is free.

The only downside I have found with this is that there are only a limited number of questions per topic and there are only three topics per subject (slightly more for working scientifically). This means that it is of limited use and some of the topics are out of date (key stage 3 science no longer has space in the National Curriculum), but it really does work well!

Overall, this is an excellent resource that can simply be picked up and used instantly. I hope they continue to update the website with more questions as this will be a great go-to resource for all secondary science teachers.

Kate Cree



Uncovering Student Ideas in Science: 25 Formative Assessment Probes

2nd edn. Page Keeley
Arlington, VA: NSTA Press, 2018
209 pp. £33.50
ISBN 978 1 68140 563 6

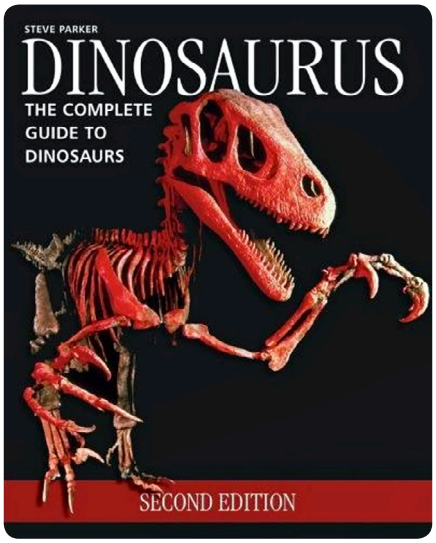
This is a book from the National Science Teachers Association (NSTA) in the United States; while sometimes this can make books less relevant to UK education, this one is still worth a look.

The NSTA like to promote inquiry-based science education, and this book provides 25 'probes' that have an emphasis on supporting conceptual learning. The author, Page Keeley, is a prolific writer in the field of science education and you can be certain that these strategies come with evidence for their effectiveness. The 'probes' are not year specific, and are aimed at pupils from reception right through to year 11 (age 16), with the objective of identifying what knowledge pupils already have. It is widely known that one of the key influences in learning is what pupils already know, making this a relevant resource to teaching today.

The book is split into two sections, one for physical science and the other for life, earth and space science. This is not necessarily how most science teachers would split topics, but the chapters are easy to navigate. Each activity is on one page, with a graphic and adjacent text. Pupils are to use this text to demonstrate their current understanding. There is a version in English, and then one in Spanish – possibly not necessary for British schools, but you never know! The main strategies you will encounter with the activities are listing, discussion, arguments and predicting/explaining. The pages following each activity explain the research behind the particular concept, and a reference to the American equivalent of the UK's National Curriculum.

This book would be a reasonable addition to the teaching and learning library of an NQT looking to broaden their assessment toolkit.

Kate Cree



Dinosaurus: The Complete Guide to Dinosaurs

2nd edn. Steve Parker
New York: Firefly Books, 2018
320 pp. £20.00
ISBN 978 1 77085 776 6

Ask any group of students '*Who likes dinosaurs?*' and most hands will probably go up, a fascination that appears to be common to all age groups. But, while we can see their bones in almost every museum (and may even be lucky enough to find some ourselves), what did these creatures actually look like? How did they live their lives? And, perhaps most intriguing of all, how did they evolve and why did they disappear? If there is one thing we have learned about dinosaurs through the decades of recent studies, it is that they were far, far more complex and sophisticated than was first thought.

After a brief introduction to geological time and continental drift this review begins with the first tetrapods, related to modern-day amphibians, and considers how these early forms developed to conquer the land and become fully terrestrial. The dinosaurs are then introduced as a group of reptiles that developed certain characteristics (reminding us that they were not the only reptiles in town) that made many of them particularly efficient as predators.

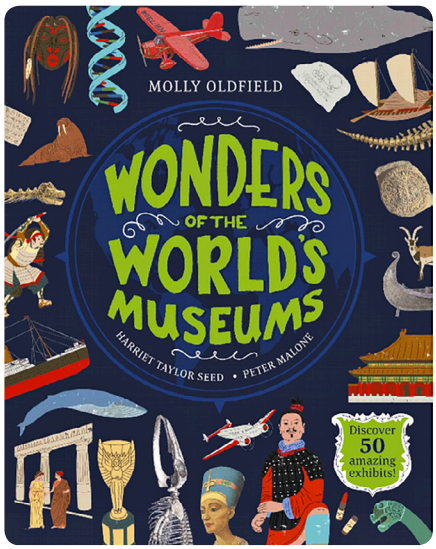
The species covered are all illustrated with imaginative reconstructions and there are 'factfiles' and brief biographies summarising what is known about them. This presentation means that, rather than being a book about dinosaurs to be read from cover to cover, this is one to dip into in order to find out more about a species encountered elsewhere (not meant as a criticism). The coverage seems wide-ranging, with all the usual favourites included, and there is a chapter devoted to '*other creatures of the dinosaur age*' to cover the flying reptiles, ichthyosaurs and early mammals.

The popularity of dinosaurs means that there are many books about them and a lot of these are very similar. Out of idle curiosity I compared this one with two others I have had for years and picked random entries to check for quality of illustration/interpretation, background information and general life history. My verdict was that it is too close to call! One particular criticism is that the publisher's promotional material emphasises the new discoveries about dinosaurs made since the first edition of this book was published in 2003 and implies that this 'fully revised' second edition brings the

field up to date; however, I was unable to find any entries for the new finds mentioned (and even if they are there the book fails to make this clear), which limits its usefulness. Also, for a '*complete guide to dinosaurs*', there is very little about dinosaur biology and natural history.

If you do not have an existing 'encyclopaedia' of dinosaurs this is as good as any; however, if you do, you may not find anything new here.

Ian Lancaster



Wonders of the World's Museums

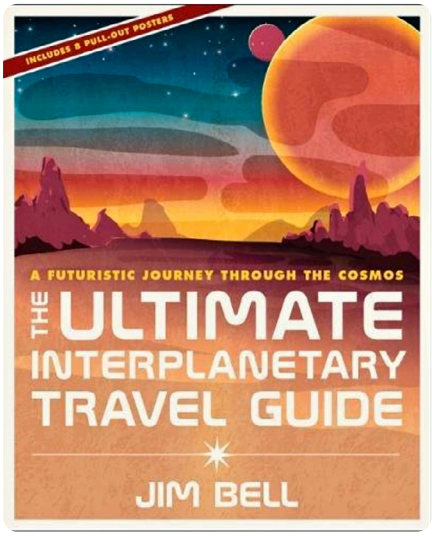
Molly Oldfield, Harriet Taylor Seed and Peter Malone
London: Wren & Rook, 2018
63 pp. £14.99
ISBN 978 1 5263 6028 1

This is an interesting book. It covers 50 items from around the world's museums and tells you about each one. The material is well planned and presented in a variety of ways: some entries have a photograph of the item, but others also have supporting photographs and other illustrations that help to put the item in its context. The explanations are very varied in style and explain not only what the item is but why it is important.

The book is easy to dip into and find something that catches your interest, whether the history of the Hall of Mirrors in the Palace of Versailles, the skeleton of the titanosaur in the American Museum of Natural History, or how to tell the age of a giant squid in the Museum of New Zealand Te Papa Tongarewa. There are items to surprise you, such as the Peacock Clock in the State Hermitage Museum in St Petersburg or the ruby slippers from the *Wizard of Oz* at the Smithsonian in Washington DC. There are also historical items that have had a profound impact on society, such as Anne Frank's Diary in the Anne Frank Museum in Amsterdam, or Dolly the Sheep in the National Museum of Scotland.

Science forms only part of the content of the book, which means that it would be a useful resource for a cross-curricular project or an interesting library book. It is probably most suitable for upper primary or lower secondary students, but it does have something for everyone and I enjoyed it.

Ann Reddecliffe



The Ultimate Interplanetary Travel Guide

Jim Bell
New York: Sterling, 2018
146 pp. £21.99
ISBN 978 1 4549 2568 2

The prospect of another 'travels in space' type book wouldn't generally have me rushing to spend my Amazon vouchers. But a fairly strong USP for Jim Bell's addition to the genre has him envisaging a time a couple of hundred years into the future when interplanetary travel is routine enough that travel bucket lists are no longer satisfied with merely Earth-bound ticks, such as trekking the Inca Trail or visiting the Great Pyramid, but also have out-of-this-world destinations in mind.

Each section, such as 'Near-Earth Asteroids', 'Field Trip to Phobos' and the like, contains subsections on the history of exploring that destination (including only part-way through that history, 2018), 'fast facts', things to do and places to stay. It is a decent mix of science – '*Why are there such giant volcanoes on Mars?*' – and travel guide – suggestions for visiting '*UNESCO Interplanetary Scientific Heritage Sites*' (of which the Moon and Mars will have plenty).

The illustrations are a mix of current-day imagery (often courtesy of NASA) and artistic visions of trips to other worlds, which, while futuristic, also manage to have a certain retro feel to them. These illustrations are an important feature of the book, such that some of them are included as detachable posters at the end. They are about A4 size, so the 'poster' claim is perhaps a little overblown, but are pretty cool nonetheless. The likes of '*Ceres – queen of the asteroid belt*' and '*Venus – see you at the cloud 9 observatory*' would make nifty additions to classroom displays and reveal a slightly more artistic side to science.

The book would be a good starting point in class for inspiring more imagination in our study of space. In the book, for example, Mercury is home to the Interplanetary Speedway, and smooth Deimos hosts the Deimos City Jazz Festival. Perhaps students could construct a case for alternative venues to host these or other events, backing up their bid with information about sightseeing opportunities and other leisure activities once there, as well as safety advice. (I loved

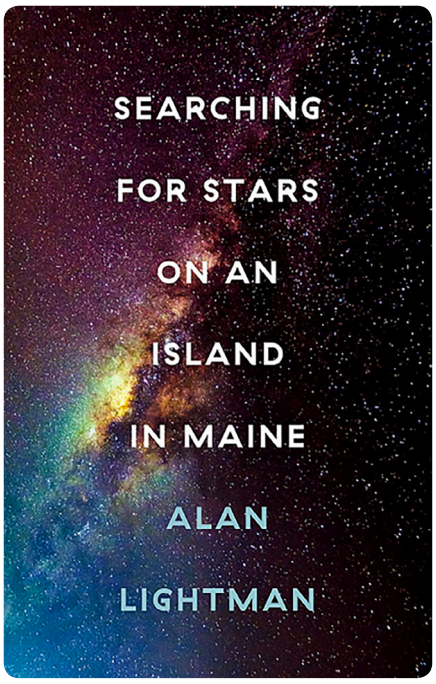
the warning in 'Get some Sun' that '*The Sun is hot!*') Another tack could be to consider the demands of sustaining life elsewhere – the book has frequent mentions of extra-terrestrial mining for example – both for minerals and water ice.

With the caveat that I am like former footballer Paul Gascoigne, with his contradictory statement that he '*never predicts things and never will*', space travel as a leisure activity must surely happen one day. While the timescale and form it takes could well be way off Bell's imaginings, it is slightly sad that, however space tourism will look, it will very likely be after our time – perhaps also largely after the time of the current generation of schoolchildren. But a multi-generational, extra-solar one-way trip to the exoplanets of Trappist-1? No thanks, I'll take Machu Picchu every time.

Ian Francis

Searching for Stars on an Island in Maine

Alan Lightman
London: Corsair, 2018
226 pp. £12.99
ISBN 978 1 47215282 4



Another book about religion and science wouldn't normally inspire, but I will happily consider one from the author of *Einstein's Dreams*, in the expectation that it is highly likely to be at least a few steps up from the usual strawman demolition job serving only to rally troops in the echo chamber.

The Island in Maine is 'Lute Island'. I couldn't find it on *Google Maps*. That may be because it is a deliberate misdirection, or because of its small size – less than a mile long – meaning it has only six families living on it of a summer, and you have to navigate there from the mainland in your own boat. It was on a rare night-time boat crossing that the author for some reason decided to turn off the lights and kill the engine. The splendour of the night sky gave him a kind of epiphany, '*falling into infinity*'.

The ensuing book is a wide-ranging collection of short essays with, at the core, the tension between the Absolutes and Relatives, the former being steadily usurped by the latter, for example, with all motion turning out to relative, *atomos* not really being indivisible, and the *aether* turning out to be nothing more than an object of faith. The attraction of the Absolutes, he says, may be their perfection and unattainability: infinity is not simply achieved by adding more and more of the finite.

Star Trek, *FaceTime* with his granddaughter, dementia, the Four Noble Truths of Buddhism and the probable evolution of *Homo sapiens* into *Homo techno* all feature. As I said, wide-ranging.

The analogies, facts and figures (for example, the percentage of scientists who say they believe in God) are naturally US-centric, and doubtless would be different for a European sample. Perhaps with his consideration of the more scholarly aspects of various religions' creation stories and views on eternity he is sometimes, at least early on, guilty of giving the undeserved special privilege or status to religious viewpoints that so frustrates Richard Dawkins. No mention either for Stephen Jay Gould's NOMA, and the idea that science and religion are better served sticking to their own patch, even as Lightman says that, while the Absolutes can never be proved, neither can they be disproved, so while some may be true and some may be false, the truth or falsity will never be known.

While this book may not directly inform one's day-to-day science teaching, at the very least it reminds us that there are plenty of people with different (i.e. less scientific) ways of viewing the world. A handy take-home message when considering our individual insignificance in the universe (or possibly, multiverses) is that, as life is short, one should simply try to do more of things that give you pleasure and less of the things that give you pain. Inspiration on a human scale – deity/deities input optional.

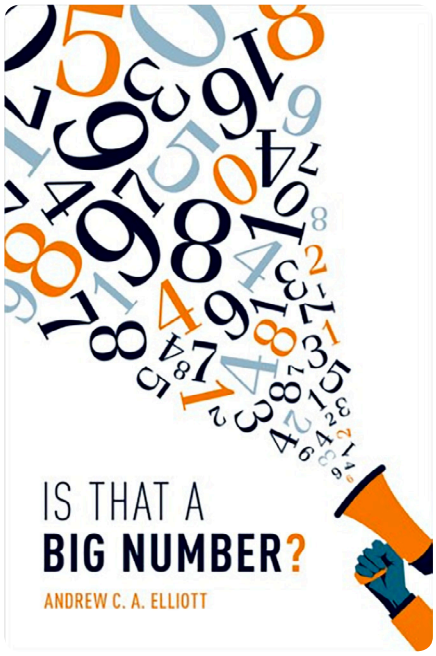
Ian Francis

Is That a Big Number?

Andrew C. A. Elliott
Oxford: Oxford University Press, 2018, 336 pp. £18.99
ISBN 978 0 19 882122 9

We can all count up to half-a-dozen objects at a glance, or make a rough estimate of the distance of an approaching car that is 100 metres away. We can even guess whether a football crowd is 5000 or 25 000, but how do we get a feel for a really big number? This author offers us a number of strategies for meeting that challenge, and enlivens his account with teasing questions and examples, such as a comparison between the amount of energy released by a burning match and the amount available in a well-known chocolate bar (it is around 1000 times more in the chocolate).

The first two parts of the book deal with counting and measuring, and the later parts deal with the application of numbers – big numbers – to astronomy, energy, finance, populations and so on.



The book is crammed with engaging facts and figures, it devotes quite a lot of time to '*five ways to think about big numbers*', and it offers some telling (if occasionally rather weird) comparisons: the Thames is twice as long as the Suez Canal, but a classic Ford Mustang is about the same length as a great white shark.

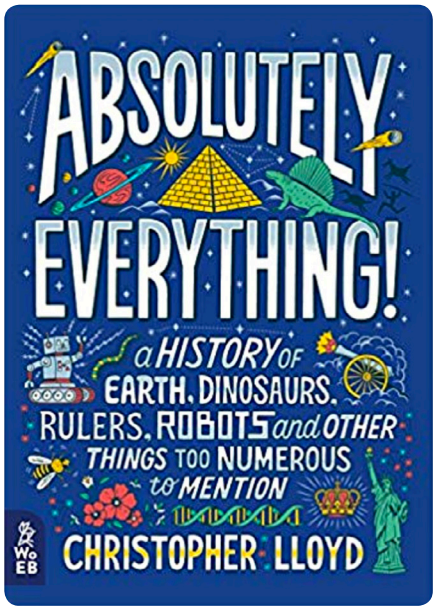
So who is this book for? Neither the publisher nor the writer makes this altogether clear. It is addressed to the reader in a personal way, using the 'you' form throughout. To judge from the quite frequent reference to American examples and data, it seems to be written with an eye to the international market. The 'number geek' will gobble this book up, and many teachers will find it helpful to have a couple of copies casually to hand for students who need something extra to get their teeth into. A reference copy would provide some examples and anecdotes to enliven many a lesson when quantitative ideas are being discussed.

Importantly, there is an associated website (www.isthatabignumber.com/). Here the author's purpose is more explicit: '*This website promotes Numeracy and Rationality in a time when these qualities are under threat*'. So this is not only an informative and engaging book, it is a campaigning one as well.

Colin Johnson

Absolutely Everything! A History of Earth, Dinosaurs, Rulers, Robots, and other things too numerous to mention

Christopher Lloyd
Tonbridge: What on Earth Books, 2018, £16.99
ISBN 978 1 9998028 2 0



The copy I had for review was an 'Advanced Reader Copy', that is, it was not proof read and was missing many images, glossary, index, and so forth. However, the book will be well worth buying because of the quality of artwork expected from the illustrator, Andy Forshaw. The text is written by Christopher Lloyd who will be known to many readers from his other works, such as *What on Earth Happened?* (2008) and *What on Earth? Wallbook* (2010). A history graduate of Cambridge University, he certainly knows how to ask the right questions in a variety of disciplines. If you like to '*ask questions as much as you like finding answers*' this book is for you. It is aimed at anyone over the age of 9 who likes to take a broad view of interrelated knowledge from several different epistemological bases: the sciences, history, archaeology, and so on. The style provides an easy read about very complex processes and situations. The author takes an evolutionary and developmental approach, starting with the origin of the universe and life. He then proceeds through the evolution of plants and animals, the emergence of civilisations, including classical empires. In Chapter 13, *Revolutions all Around, 1543–1905*, he looks at the sciences, freedom and robots. The final chapter (15), *To be continued, 1945–Present*, examines the current shape '*of the world we know and what might come next*'. The book should be in all primary school and in early secondary school libraries. It may not deal with *Absolutely Everything*, but it is a great guide to thinking about many issues!

J. Keri Davies

Reviewers

Kate Cree is a Science teacher in the North West.
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