

BOOKSHELF

A Short History of Nearly Everything

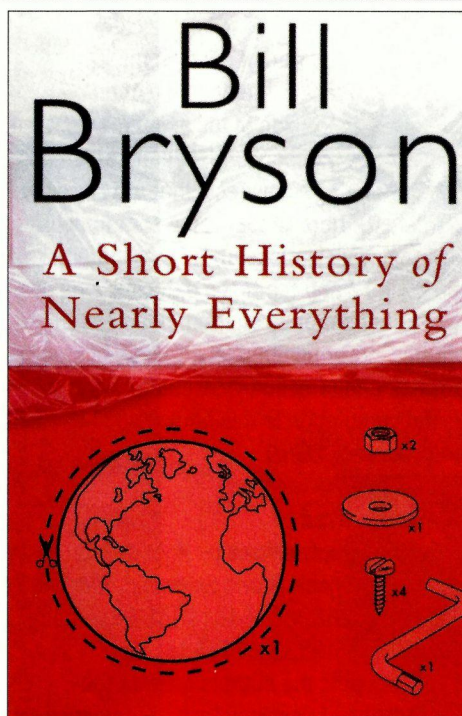
by Bill Bryson, Doubleday. ISBN 0385408188, £20. (Broadway, ISBN 0767908171, \$27.50 in the US.)

Bill Bryson simply could not write another paragraph about being presented with a disappointing dish of food, he explained on a book tour in May. Fortunately, he had other ideas. The writer best known for his humorous travel accounts was struck by how little he really knew about the planet he called home. The result is the modestly titled *A Short History of Nearly Everything*.

Any scientist – or for that matter science journalist – inclined to resent Bryson's hubris will find much to feel smug about in this book. There are a number of errors, some of them cringeworthy, and Bryson draws from popular sources such as *The Economist* at least as frequently as he does from scientific papers or his own reporting.

But to dwell on such technicalities would be to overlook the fact that Bryson has written an entertaining and informative 500-page book about science, which in itself is an accomplishment. Quirky characters from the history of science make up a large part of Bryson's material, but a larger theme is his sense of wonder at details of this universe we are lucky enough to inhabit. He spurns scientific notation, instead illustrating very large and very small amounts with passages such as: "If you could fly backwards into the past at the rate of one year per second, it would take you about half an hour to reach the time of Christ, and a little over three weeks to get back to the beginnings of human life. But it would take you 20 years to reach the dawn of the Cambrian period. It was, in other words, an extremely long time ago and the world was a very different place."

From analogies like this, as well as from Bryson's apocalyptic depictions of the havoc that supervolcanoes, meteor impacts, or climate change would wreak on civilization as we know it, the reader is left with a sense of mankind's rare and precarious place in the universe. We are here only because our ancestors (human and otherwise) were in the right place at the right time; we are anomalous inhabitants of a bacteria-dominated planet; we have existed as a species for a pitifully brief period of time. This thread runs through the book, weaving a coherent whole from what otherwise might have been nothing more than a motley assemblage of big numbers, interesting facts and comically eccentric scientists.



The book is at its best when Bryson goes into the field (or the lab or museum). Through him we meet the Reverend Robert Evans, an Australian "titan of the skies" who hunts supernovae from his back sun deck; Paul Doss, a Harley-Davidson-riding Yellowstone National Park geologist; and Len Ellis, who has studied mosses behind the scenes at London's Natural History Museum for the past 27 years. With these conversations, Bryson paints a picture of what day-to-day science is like. *Shawna Williams, CERN.*

Quantum Chromodynamics – High Energy Experiments and Theory by Günther Dissertori, Ian G Knowles and Michael Schmelling, Oxford University Press. ISBN 0198505728, £60.

Thirty years have passed since quantum chromodynamics (QCD) was introduced, and it has now become the generally accepted theory of strong interactions. This book is intended to give an overview of the various aspects of QCD in lepton–nucleon scattering, in e^+e^- annihilation and in hadron–hadron scattering.

The authors begin with a general introduction to the quark model and its features, such as the colour quantum number. This ends with a demonstration of the QCD Lagrangian, and the theory is then presented in detail, followed by applications to e^+e^- annihilation, to lepton–hadron scattering and to purely hadronic reactions. In particular, there is a detailed

description of the integro-differential DGLAP equations for describing scaling violations. The various aspects of the renormalization group equations are also described, including the quark mass terms. Deep-inelastic scattering is discussed, to leading order and next-to-leading order, together with the BFKL equations, the Drell–Yan process and a number of hadronization models.

A description of the related experimental work follows, starting with accelerator systems and ending with the detectors, in particular the ALEPH detector at LEP. The authors then move on to describe the general concepts of QCD analysis in e^+e^- annihilation, in lepton–nucleon scattering and for hadron colliders. The discussion centres on structure functions and distribution functions. The HERA results are described, both for neutral and charged-current interactions, along with results from neutrino–nucleon scattering. Here, the gluon distribution in the nucleon and the strange quark distribution are also considered, as well as the various sum rules (Adler sum rule, Gross–Llewellyn Smith sum rule, Gottfried sum rule, sum rules for polarized structure functions). This is followed by a description of aspects of hadronic processes, such as the Drell–Yan process, and the production of direct photons.

The authors devote a special chapter to a detailed discussion of the strong coupling constant. This is deduced from the ratio R , measured in e^+e^- annihilation, from R_τ , from sum rules, from the physics of heavy flavours and from measurements at hadronic colliders. Tests of the gauge structure of QCD, and especially of the colour factors, are considered next, followed by an analysis of the leading-log results of QCD.

The final chapters look at the difference between quark and gluon jets, and various aspects of fragmentation (multiplicities, momentum spectra, string effects, colour coherence, Bose–Einstein correlations and colour reconnection). Appendices on elements of group theory, dimensional regularization and scaling violations in fragmentation functions are also included. Exercises are provided after each chapter and the solutions are described at the end of the book.

The book concentrates on those aspects of QCD that have been tested in experiments. The largely unknown features of the theory, when it comes to the low-energy properties and confirmation, are only superficially discussed. Aimed at graduate students,

post-doctoral physicists and professional researchers in particle physics, this book can be recommended to both experimentalists and theorists interested in QCD.

Harald Fritsch, University of Munich.

Fundamentals of Electroweak Theory

by Jiri Horejsi, Charles University Prague, The Karolinum Press. ISBN 8024606399, €50 (\$50).

This book is an introduction to electroweak theory at the graduate-student level. The first 100 or so pages are dedicated to the old weak interaction theory, from Enrico Fermi to Nicola Cabibbo. The remainder of the book then goes on to describe the modern standard gauge theory of electroweak interactions.

Overall, I had a favourable impression on reading this book. The main qualities are clarity, formal simplicity and a good sense of physics. Tree-level unitarity constraints and the good behaviour of amplitudes at large energies are often used as guiding principles for the discussion of Standard Model

couplings. A number of exercises are proposed at the end of each chapter.

One drawback is the absence of an adequate discussion of the experimental tests of electroweak theory and, in general, of the phenomenological aspects that are currently of interest. There is not even a summary or any basic calculations about the properties of the W, the Z and the Higgs particles. One or two further chapters on modern collider physics, covering the past 20 years of electroweak phenomenology, would provide a useful completion to this book.

Guido Altarelli, CERN.

Books received

Universal fluctuations by Robert Botet and Marek Ploszajczak, World Scientific. Hardback ISBN 9810248989, £46 (\$68). Paperback ISBN 9810249233 £24 (\$36).

In this book, the authors present the appearance of universal limit probability laws in physics and their connections with the recently developed scaling theory of fluctua-

tions. They conclude by describing how a new description of hadronic matter is appearing as the consequence of this approach.

Towards a nonlinear quantum physics by J R Croca, World Scientific. Hardback ISBN 9812382100, £31 (\$46).

The author presents evidence that Heisenberg's uncertainty relations are not valid in all cases, and goes on to derive a more general set of uncertainty relations.

Advances in non-linear dynamos by Antonio Ferriz-Mas and Manuel Núñez (eds), Taylor and Francis. Hardback ISBN 041528788X, £80.

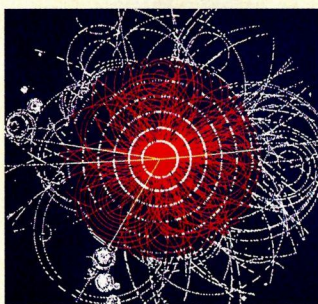
The latest in a series on the fluid mechanics of astrophysics and geophysics, this book presents an updated and coherent view of recent advances in the field, with contributions from leading authors. A useful reference book for postgraduates and researchers, it covers both kinetic and dynamo approaches to the subject.



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Image shows a simulation by the ATLAS experiment of the decay of a Higgs boson into four muons (yellow tracks).



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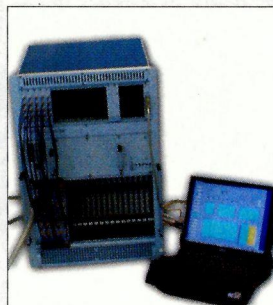


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