

The other side of the coin, however, is that one picks up this text expecting more; on quick perusal, that seems justified. The chapters are arranged logically from a pedagogical standpoint. The type and layout are pleasing. Each chapter is self-contained and has a thoughtful introduction, clear subheadings, numerous worked examples, checkpoint sections in the body of many chapters to keep the student or reader on board, end-of-chapter summary sections, references, and problems with numerical answers to each. Many of the references are to original works; others are to modern Web sites. There is also a very useful compilation of shielding data both in the chapters and at the end of the book.

However, the deeper one examines the text the more some very annoying oversights and errors become obvious. This problem starts on the very first page, where it is stated that health physics “brings together science, technology, human values and public policy to provide safe levels of protection for workers and the public from radiation, and once these safe levels have been met, to further optimize protection below them.” While there is much to admire in this statement, since it explicitly recognizes that radiation protection is based on more than science, there is also much to worry about—if not outright criticize.

Does the author really want to revisit the controversy over support by the field of health physics of the notion of a “safe” level of radiation exposure? And is an introductory textbook the appropriate place to rejoin that battle? Moreover, what can it possibly mean to “further optimize protection” below a “safe” level? Further, on the same page, there is a diagram of the steps from the source of radiation to the risk to people. And even though the deposition of energy and its effects on people are depicted, no mention appears here—or elsewhere in the book—of the many indirect radiation effects, the understanding of which are crucial to the understanding of radiation’s bio-effects. This is in part due to the fact that the book disavows any coverage of radiation bio-effects, despite the fact that many radiation protection issues and practical consequences are derived from them. If discordances like these occurred infrequently, readers could easily put them aside and ascribe the issue to their own personal sensitivities or idiosyncrasies.

However, examples of omissions or errors occur in almost every chapter. Chapter 4 represents the Auger

process as the emission of an x ray that then interacts with another orbital electron, rather than as a direct coupling of the excited atomic state to the orbital electron state. Chapter 7 covers the interactions of radiation with matter and introduces the terms “radiation dose” and “effective dose equivalent,” yet the latter term, which has a significant meaning in modern radiation protection, is never defined nor used again. The index is quite comprehensive in some areas but lacking in others; for example it contains “force of nature” and “dose equivalent” but does not contain “fluence,” “flux,” “dose,” or “albedo,” which are all dealt with in the text.

In overview, the book falls short on the theoretical and didactic side, since a number of issues are dealt with on a purely phenomenological basis and the explanations rely only on stated facts. On the practical shielding side, the author makes few attempts at actual calculations. A minor presentation of shielding issues for diagnostic radiology facilities is incomplete and no information is given about more significant problems of shielding, such as in radiation-therapy facilities.

While more instances could be given, the point is made. What purports to be “one book” for protection cannot stand alone in its coverage of radiation physics or shielding. That the book does not give enough theoretical detail of various processes is acceptable in light of its stated purpose—to serve the needs of a practical professional. But the text gives incorrect or misleading information, sometimes directly and sometimes by omission, that can compromise a student’s understanding or further study. Any teacher attempting to use it as a text—which its format makes it appear to be—would have to supplement it with books like *Introduction to Radiological Physics and Radiation Dosimetry*, by Frank H. Attix (Wiley, 1986), on the theoretical side, and *Radiation Shielding and Dosimetry*, by A. Edward Profio, (Wiley, 1979), on the didactic side.

Permissible Dose by J. Samuel Walker is subtitled “A History of Radiation Protection in the Twentieth Century.” In reality it is “the third in a series of volumes on the history of nuclear regulation sponsored by the United States Nuclear Regulatory Commission (NRC).” The author even discusses his embarrassment with a “subtitle suggesting this book covers the entire subject of radiation protection since the discovery of x-rays . . . [In] keeping with the institutional

setting in which I write, the book focuses on the role of federal agencies in radiation safety and the evolution of radiation protection regulations.”

Despite these statements, the subtitle remains unfortunately misleading. Little coverage is given here of the history of the science that underlies permissible doses, but much is said about the political and regulatory background as seen by the NRC. Given the author’s position as the historian of the NRC, such focus is understandable. The result, however, is much like reading the diary of the NRC. It contains many interesting details through one participant’s perspective.

Chapters 1 and 5 are the most balanced and generally informative, as they cover the hazards and ambiguities of radiation effects. Chapters 2, 3, and 4 are pretty much the history of the NRC as seen by a partisan. Not that this history is without redeeming interest, but one is cautioned to read more broadly on issues such as ALARA (as low as reasonably achievable), misadministration of dose, and NRC/Environmental Protection Agency relations, if the truest picture is desired on these matters.

Subjects are copiously footnoted on every page with references that, in keeping with the popular level of the coverage, are most often to the general press. There are a few errors and mischaracterizations, such as reference to atomic ionizations as changes in the composition of the atom’s nucleus, and characterization of medical opposition to the misadministration-of-dose rule as their “attitude” toward government regulations. However, minor deficiencies would probably pass without effect among the book’s intended, lay audience. More historical photographs of the original participants would have helped to satisfy a reader’s expectations, especially pictures from old AEC files that may not be generally available.

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Nine Crazy Ideas in Science: A Few Might Even Be True

Robert Ehrlich
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Every year, many books published for general audiences treat controversial ideas related to science, technology,

and public policy. Few cover as wide a range of topics as does Robert Ehrlich's *Nine Crazy Ideas in Science*, and even fewer so well scrutinize the strengths and weaknesses of such ideas. In the first chapter, Ehrlich explains that he selected ideas for inclusion that are "far from being completely settled" (which excludes continental drift and cold fusion) but which are nevertheless scientific: "They can be supported or refuted by data."

Each of the ideas is treated in its own chapter, which can be read in almost any order. The chapter titles state the ideas: "More Guns Means Less Crime," "AIDS Is Not Caused by HIV," "Sun Exposure is Beneficial," "Low Doses of Nuclear Radiation Are Beneficial," "The Solar System Has Two Suns," "Oil, Coal, and Gas Have Abiogenic Origins," "Time Travel Is Possible," "Faster-than-Light Particles Exist," and "There was No Big Bang."

One has to admire Ehrlich's audacity in offering critical analyses over such a broad front. In the introductory chapter, he lists and explains a set of questions to be used in evaluating each of the ideas. Some of these, such as "How many free parameters does the theory contain?" are very familiar to physicists. Others, such as "Does the proposer have an agenda?" are seldom explicitly addressed in scientific dialogues.

Most of the writing is both clear and lively. In one respect it is downright whimsical: At the end of each chapter, Ehrlich assigns the idea at hand a rating of zero to four "cuckoos," with zero meaning "why not?" and four meaning "certainly false." I will not disclose his assessments here, but it's a safe prediction that most readers will disagree with at least one or two among the nine assigned ratings.

Comparing one's "bottom line" with Ehrlich's is entertaining, but the genuine value of his book lies in the analyses. General readers (and also students in college courses on "science and society" or "science and public policy") can learn from the book how to evaluate controversial claims. I heartily concur with Ehrlich's assertion that "we should base policy choices on the best science available, whether or not it happens to agree with what we wish might be true."

Some chapters will be more accessible to the general reader than others. Ehrlich himself identifies the last two ideas (on tachyons and on the early universe) as the most demanding mathematically. Among the other chapters, the most clearly written are on guns and crime, on AIDS/HIV, and on the possible existence of a Nemesis star.

The book is not flawless. There are a few nontechnical errors, such as a sentence fragment near the bottom of page 195. The sievert is used (p. 74) well before it is defined (p. 81). There is apparently a wording error on p. 120 in the comparison of two probabilities. More globally, some of the discussions that involve statistics are likely to test the general reader's perseverance. Although numerous references for each chapter are listed at the end of the book, there is no commentary with them to guide the general reader.

In spite of these imperfections, the book is an important addition to an underpopulated genre of science books: It critically examines both sides of interesting, important, and unsettled arguments. In my view, those of us who teach science to nonscience majors must continually encourage them to base their beliefs on evidence rather than mere prior preference. Ehrlich has given us an excellent additional resource for that task.

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