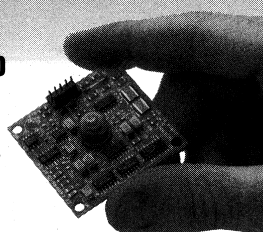


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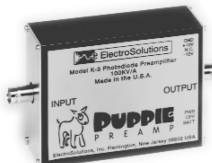
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young scientists in a field replete with bright young scientists. They have made numerous important theoretical and experimental contributions to this field, most notably the first experimental implementation of a quantum algorithm, by Chuang and coworkers, in 1997.

The book is divided into three sections, dealing respectively with fundamental concepts, quantum computation, and quantum information. The authors rightly choose to examine key issues in depth rather than attempt a mile-wide, inch-deep, catholic approach. They concentrate on the development of an understanding of quantum information theory, of what a quantum computer can do and why it will be powerful, rather than on how such a device can be constructed. Descriptions of experiments are confined to a single chapter that serves to whet the appetite and direct the reader to other sources.

While all of the topics covered in the book are of considerable importance and interest, others of possibly equal or greater import—such as decoherence-free subspaces, continuous variable quantum information processing, or the characterization of quantum state entanglement—are covered only in passing or not at all. When describing an emerging field such as this, it is difficult to know what will be the most popular topic a few months hence, let alone judge which are of lasting importance to the field as a whole. Thus, I cannot really level criticism at the authors for such omissions; indeed, the background material needed to assimilate such new developments is all very well covered.

In a work of this size, minor errors are inevitable. The authors are maintaining a web site with errata at www.squint.org/qci.

There are quite a few books published on quantum information science, none with either the scope or depth of the Nielsen–Chuang work, but which nevertheless might serve as suitable complements to it. The compendium works *The Physics of Quantum Information*, edited by Dirk Bouwmeester, Artur Ekert, and Anton Zeilinger (Springer, 2000), and *Scalable Quantum Computers: Paving the Way to Realization*, edited by Sam Braunstein and Hoi-Kwong Lo (Wiley, 2001), offer much more information on experiments and technology development. Other books on this field, aimed at working physicists (as opposed to the plethora of semipopular works), are: *Explorations in Quantum Computing* by Colin Williams and Scott Clearwater (Telos, 1998, with a

new edition to appear), *Introduction to Quantum Computers* by Gennady Berman, Gary Doolen, Ronnie Mainieri, and Vladimir Tsifrinovitch (World Scientific, 1998), and *Introduction to Quantum Computation and Information*, edited by Hoi-Kwong Lo, Sandu Popescu, and Tim Spiller (World Scientific, 1998), all of which are shorter, more introductory works.

The book is very well written and a pleasure to read. The authors assume initially only minimal knowledge of quantum theory and/or computer science, and bring the reader up to the current state of the art as it pertains to this field. Problem sets to aid the student and instructor are included. The text is enlivened with occasional insertions of wit and apt quotations. In this spirit, I will conclude with a quotation from Niccolò Machiavelli's *The Prince*: "There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things."

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Managing Science: Management for R&D Laboratories

▶ Claude Gelès, Gilles Lindecker, Mel Month, and Christian Roche
Wiley, New York, 2000. \$79.95
(359 pp.). ISBN 0-471-18508-6

Collectively, Claude Gelès, Gilles Lindecker, Mel Month, and Christian Roche have many decades of involvement in managing accelerator laboratories, primarily at CERN (European Laboratory for Particle Physics) and at Brookhaven National Laboratory. They note in an informative preface to *Managing Science: Management for R&D Laboratories* that "scientists tend not to respect management as a scholarly field on a par with the hard sciences—or with sociology or economics for that matter." These authors, however, obviously do respect management as a scholarly field; they have developed and taught university courses on the management of scientific laboratories. Now they offer their insights in a book that covers nearly every topic of value in the management of nonprofit research facilities and organizations.

The emphasis here is on facilities and organizations. This is not a book about the art of managing individual

scientists. It is a book for committed professional managers of scientific research organizations or students and scientists who want to become such.

The performance of an industrial organization is ultimately measured in terms of rate of return on investment. No such simple measure exists for a nonprofit organization. The most important product of a scientific laboratory is increased knowledge, but how can one compare the output of knowledge to the input of funds? Faced with

this quandary, the authors adopt a pragmatic approach, repeatedly emphasizing the difficulty of accurately assessing organizational performance but providing useful guidelines and best practices for improving it.

The book is divided into a major and a minor section. Part 1, The Management Structures, covers topics such as why nonprofit research organizations exist and how they are created, developed, organized, and operated. I enjoyed the discussions of deci-

sion-making systems and organizational communications. The historical series of organizational charts from CERN and DESY (the German electron-synchrotron laboratory) is one of many delightful appendices. It shows a tendency of organizations to fluctuate between predominantly "line" and more "matrixed" structures. The ideal line and the ideal matrix never appear, but seemingly, each newly appointed director-general tries for the traditional line hierarchy and then moves toward a matrix (because accumulated experience generates wisdom?). Another appendix analyzes the reasons for the demise of the Superconducting Super Collider. The authors adopt an unnecessarily tentative tone for their conclusion that all involved parties were part of the failure. Isn't it usually that way?

The material on project management, human resources, and financial management is standard fare and is treated in greater depth in the extensive literature on project management. I skimmed very quickly through the material on logistics, general services, and supply chain as I raced to get to the intriguingly titled Part II, The Human Drama. This is a smaller grouping of chapters, each mirroring a topic already covered to some extent in Part I but focusing on the human, or psychosocial, dimensions of that topic. Here I found some of the writing a bit murky.

The authors stress the subjectivity of so much of human knowledge, which leads individuals to make decisions that sometimes produce organizational failure. Terms such as "destructive coherence" and "decoherence" are used to describe such organizational states, with no serious attempt to define these words in context. Finally, some of the passages read all too clearly as transcriptions of classroom lectures, in which the distinguished professor seeks to distill some life wisdom for his students. It actually comes across as sound advice now that I'm 50 years old, but I don't recall having much capacity to appreciate this sort of advice when I was in my twenties.

Nevertheless, the patient reader is rewarded by an epilogue that clarifies and summarizes the authors views on organizational stagnation and failure. Four rules are given for effecting renewal from within the organization. My favorite is Rule 4, "Always remember, be pragmatic."

THOMAS N. THEIS

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