impact of the emerging developments in process engineering technology on World-class Benchmarks. The book may be of interest to process technologists and is definitely worth reading by all who are interested in Benchmarking in the Process Industries.

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Principles Of Physical Chemistry: Understanding Molecules, Molecular Assemblies, Supramolecular Machines

Hans Kuhn and Horst-Dieter Försterling, John Wiley & Sons, Ltd, 1999, 970 pp, £27.50, paperback, ISBN 0-471-96541-3, paperback, ISBN 0-471-95902-2, hardback

This book reflects a significant effort to present most of the topics traditionally covered in Physical Chemistry textbooks as well as fast developing subjects (biophysics, supramolecular machines) in a novel and unconventional manner. Thus, the book constitutes an alternative approach to Physical Chemistry not only with respect to its content but, more importantly, with respect to the method of presentation and structure of its material.

The traditional sequence of introductory courses in Physical Chemistry, which involves the coverage of classical thermodynamics first, followed by that of classical and quantum mechanical statistical thermodynamics, is now reversed and the postulates of quantum mechanics are introduced right from the beginning (noticeably, the very first chapter of the book is devoted to wave-particle duality). The authors choose to treat Physical Chemistry subjects with emphasis on the microscopic origin of the macroscopic properties of the matter. Modelling the behaviour of atoms and molecules as well as their interactions by means of quantum and classical mechanics leads to the prediction/interpretation of the macroscopic behaviour of systems of increasing complexity. The principles of Physical Chemistry thus derived are checked and applied to experimental facts throughout the text.

The first third of the book (Chapters 1–10) is, in my opinion, the best part of it and deals with quantum mechanics basics, atomic properties, the chemical bond and intermolecular forces. It introduces all basic types of spectroscopy in connection with predictions of atomic and molecular behaviour. The underlying mathematics is rigorous but excellently presented, in a clear and step-by-step manner (this is a general feature of the mathematical content of the entire book). The chapters on atomic and molecular orbitals are very comprehensive and contain sufficient drawings, while emphasis is given in π-electron systems and the application of the Hückel molecular orbital method to a number of systems. Also, the chapter on light absorption and emission is full of useful examples.

The second part of the book (Chapters 11–21) deals with the more traditional aspects of Physical Chemistry such as equilibrium thermodynamics, chemical and phase equilibrium and chemical kinetics. Again, emphasis is put on the microscopic models describing the macroscopic properties of matter, with the help of quantum and classical statistical thermodynamics. Although the presentation of the principles (especially in the case of the laws of thermodynamics) is skilfully done based on a number of typical examples, some secondary but standard subjects (for example activity coefficients, azeotropes, electrochemical kinetics, etc.) are either only briefly discussed or not presented at all. Obviously, this was due to space limitations since the book contains extensive material on quantum mechanics and new areas of interest (see final chapters), but I still feel that the material omitted is required for undergraduate level studies.

The final part of the book (Chapters 22–24) covers, in a very concise way, organised assemblies (films, liquid crystals and polymers) with particular emphasis on their applications and discusses two brand new topics in Physical Chemistry, namely that of supramolecular assemblies and the correlation of supramolecular engineering with the origin of life. Many fascinating examples of supramolecular machines (that is of systems of co-operating molecules) such as sensors, transducers, processing devices, memories and energy converters are described. The principles of tailoring the behaviour of matter by using the lock-and-key technique and programmed environmental change (supramolecular engineering) are extended to the rationalisation of the origin of life, the living form of matter. This last chapter, although profound and thought provoking is rather too advanced and demanding to be included in an undergraduate textbook.

This work contains a number of numerical problems and their solutions, aiming at the application of the presented principles to characteristic cases. Other useful insets include ‘Boxes’ containing the discussion of specific topics that are not covered in the main text body, and ‘Foundations’ which contain detailed proofs of relationships and in depth analysis of important points. Finally, an extensive list of up-to-date further readings is given for each chapter.

Summarising, ‘Principles of Physical Chemistry’ by Kuhn and Försterling is a very interesting and truly novel approach to the subject which could be used as an auxiliary textbook for undergraduate science students (chemists, physicists, biologists) and should also be useful to teachers who want to get familiar with a modern look into Physical Chemistry.

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Managing Science: Management For R&D Laboratories
Claude Gelès, Gilles Lindecker, Mel Month and Christian Roche, John Wiley & Sons Inc., 1999, 359 pp, £51.95, hardback, ISBN 0-471-18508-6

Creativity is not important for high energy physics research. At least, that's the conclusion I draw from this book, which has not a single mention of the subject. For a text that purports to present "a complete set of tools for the management of research and development laboratories and projects", I find that surprising.

Clearly in a relatively slim volume, the authors cannot include everything, but the book has a peculiar imbalance. It is not the generally applicable R&D management text book I had expected from the publisher's pre-publication literature. The authors, all the examples and most of the data, come from a high energy physics background. The case studies are all US-based, despite the authors' extensive European experience. Are 'Big Science' laboratories really so isolated from their environment?

The 12 chapters of Part I cover topics such as; the reasons for building the laboratory, its organisation, policy, project management, human resources management, finance and cost, services, and outside suppliers.

Matrix and line structures are introduced very briefly and illustrated by 11 pages of organisation charts. Unfortunately there is little real discussion of the pros and cons of each type, beyond observing that matrix structures are "especially susceptible to miscommunications and behavioural anomalies". A whole chapter describes the problems of handling mail, but without any reference to the key problem of who is authorised to say/send what to whom (R&D results are often confidential).

I was a bit surprised to see that the first item listed under 'Development Plan' in the 'Plans Cascade' was 'Divestment'! No wonder they had so much 'deviancy' (see later).

There is nothing in the text on research project selection and only the briefest of discussions on portfolio design, presumably because of the limited number of relatively large projects handled by high energy physics laboratories. In 'industrial' laboratories with a multitude of projects and perhaps 'sponsors', these are seriously time-consuming activities.

A number of pages are, of course, devoted to quality assurance, though the authors observe that ISO 9000 does not guarantee that products or services are of the quality demanded by the customers.

The six chapters of Part II deal with the people in the organisation and the effort needed to build coherent operating units.

The authors quite correctly identify that human behaviour can become a dominant factor in an organisation. They then go on to introduce the concept of 'organisation deviancy', which results from a 'build-up of workplace behaviour'. I suspect, however, that this is a characteristic of the sort of laboratories experienced by the authors. Judging by the eight pages of charts that illustrate this topic, once such laboratories are set up, they go through life with a steadily ageing population. The oil/chemical company laboratories, which I have been in or around during the last 25 years, have had constantly refreshed populations, as we regarded staff transfers as an essential component of technology transfer.

Possibly as a consequence of the static population the authors seemingly come from, staff selection is only briefly dealt with, concluding that interview by a selection board is "an efficient way to judge a candidate". No mention is made of more modern techniques such as assessment centres.

I also found it surprising that, in these days of constant flux, there is only a single page devoted to the management of change and no reference to further reading.

The book is very variable in its level of detail. For example, we learn that it is a good thing to have students on site. Their rooms must have a "small bath" and should be cleaned "at least twice a day". On the other hand, negotiation, "a fundamental and universal activity of management", is dealt with in four lines! Some of the writing is rather obscure and it is not all easy reading. There are several typing errors and the first three equations in the book also have errors in them. I suspect that at least some of these problems arise from the book's having several authors.

However, it is not all bad and, like the curate's egg, parts of it are excellent. In that respect I found Part II — 'The Human Drama' rather more thought provoking than Part I — 'The Management Structures'.

The book contains a number of gems which I recognise from my own experience. For example, "When a space problem arises, top management needs a strong personality to find a solution for a seemingly trivial problem." The space referred to is, of course, of the office rather than of the universe variety! The authors discuss the problems of performance measurement in an R&D environment. Apparently a Nobel prize is a useful indication. RAE assessors please note!

While we are on the subject, some amazingly candid tips on appraising organisations are given towards the end of the book. They include; "Are you meant to give an honest assessment?", "Will you cast a blind eye in particular areas?", and "Is the outcome predetermined?"

There is an impressive list of "selected references" at the end of the book but, unfortunately, there are no links to the main text. Such links might have gone some way towards correcting the omissions I have mentioned above.

This is not a comprehensive DIY guide to research management for the beginner, but it does illustrate some of the pitfalls to be avoided. It includes a number of case studies and exercises which will be useful for stimulating discussion. However, Bamfield's book [1] might be a better starting point on this topic for chemical engineers.