tions of fluorescence applications, enabling one to quickly appreciate the many questions and problems in the field of fluorescence. *Molecular Fluorescence* is more a textbook than a monograph, and therefore it is of special interest for students and beginners in the field, and can be recommended.

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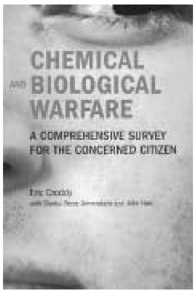
Chemical and Biological Warfare. A Comprehensive Survey for the Concerned Citizen. By *Eric Croddy, Clarisa Perez-Armendariz* and *John Hart*. Springer-Verlag, Heidelberg 2002. 306 pp., hardcover $ 27.50.—ISBN 0-387-95076-1



As the title states, the authors of this book have set out to give the "concerned citizen" a comprehensive overview of chemical and biological weapons. In their descriptions of the various agents that can be used and their effects they have succeeded very well, but the book also contains many serious errors and shortcomings. Right at the start, the authors uncritically adopt a new definition of the term "weapons of mass destruction" proposed by Ken Alibek, a former emigrant from the Soviet Union. That term was not coined by Marshall Zhukov in 1956 as they state, but by the UN Security Council, to distinguish nuclear weapons from conventional weapons. Also the expression "the poor man's atomic bomb" did not originate from President Rafsanjani of Iran in 1988, but from the American industrialist George W. Merck, head of the United States Committee on Biological Weapons, shortly after World War 2.

Again, it is not true that, after the signing of the Geneva Convention in 1925, which banned countries from starting to use chemical or biological weapons in war, there was no further open discussion about the control of such weapons. After 1925 several years of discussion resulted in the very comprehensive MacDonald Plan, which aimed to prevent the development and production of such weapons, but that failed in 1933 when Germany and Japan pulled out of the League of Nations. Controls on the export of such materials did not first come into force with the signing of the Chemical Weapons Convention, but earlier through the actions of the "Australian Group" set up in 1984. Unfortunately it is not true that the conventions on chemical and biological weapons are "almost universally accepted". A quarter of the world's nations have not yet ratified the agreements. The authors uncritically accept and echo the USA's condemnation of some countries for allegedly possessing weapons of mass destruction, without including any reference to the clear mistakes made by the CIA in gathering such information. They also fail to mention Hitler's decision not to engage in biological warfare; instead they state incorrectly that his injury caused by poison gas during World War 1 led him to hesitate about using chemical agents in war, whereas in fact he took a keen interest in their development and production.

Bacillus anthracis was not isolated by R. Koch in 1876, but in 1849 and 1855 by A. Pollender. The alleged "convincing evidence" that in World War 1 the Germans used glanders against the Russians does not exist, but the authors do not mention that anthrax- and glanders-inducing agents were probably used in several other countries. Furthermore, it is irresponsible to report, without critical comment, that after World War 1 "some people" believed that Germany had deliberately spread the influenza virus which killed 20–50 million people worldwide in 1918. The name of the inventor of tabun was not "Schräder" but Gerhard Schrader, and that nerve gas was produced not in "Dyenfurth" but in Dyhernfurth. In 1945 the tabun factory fell into the hands of the Red Army. Thus, the assertion by a Soviet expert, repeated in this book, that no knowledge about the production of nerve gases came to light until 1957, is incorrect.

The arrangement of the book's contents also invites criticism. For example, the description of chemical and biological weapons comes before an account of their history. The placing of the last chapter on the role of vaccination in biological warfare seems quite inappropriate. Although the problem of developing antidotes and vaccines to protect against attack by chemical and biological weapons, and also to protect their users, is undeniably important, this chapter of 17 pages is too long, especially when compared with the space devoted to other important aspects—for example, only 12 lines are devoted to the role of measures to build trust. Considerable attention is given to measures for preventing war-induced epidemics, but that has nothing at all to do with biological warfare. In this connection the authors completely overlook the effect of military vaccination activities in arousing distrust, and ignore the pressures that are evident throughout the world for such activities to be transparent and coordinated, either within a country or, better, internationally. That would also help to discourage biological terrorist attacks or to improve preparedness against them. That thought would have made a good conclusion for this book, instead of considering the populist question of whether Osama Bin Laden is on the point of using anthrax-inducing agents as a terrorist weapon, or is indeed already doing so.

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Science, Truth, and Democracy. By *Philip Kitcher.* Oxford University Press, Oxford 2001. 219 pp, hardcover $ 29.95.—ISBN 0-19-514583-6

Imagine that scientific inquiry was truly democratic. Representatives of the public would make significant contributions to decisions about funding priorities and about which scientific endeavors are regarded as significant. Such public participation surely seems like a good thing in the abstract. By representing all affected parties, the demands of progress would be balanced with values such as justice and equality.

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Ideas such as this one have long been discussed, but quickly shelved in favor of the more expert-centered decision-making structures in use today. Modern science is so complex, it is argued, that even if the representatives of the public at large acted in good faith, they wouldn't possess the requisite knowledge to make informed and balanced judgments about scientific priorities. This alleged "tyranny of the ignorant" would be more than just inconvenient, it would be positively devastating. Reflecting quite rationally on their self interests, representatives of the public would give short shrift to basic science, instead favoring the areas of applied research that would be most likely to bring swift and direct benefits to their constituents. This, however, would eventually bring the scientific enterprise to a halt because basic research provides the fuel for applied science.

While these criticisms of "democratic science" have seemed to many to be insurmountable, philosopher Philip Kitcher takes them up in his groundbreaking new book *Science, Truth, and Democracy.* In this book, Kitcher defends an ideal which he calls "well-ordered science", a vision of a scientific community that uses democratic structures to make decisions about the direction and scope of research. His arguments are insightful, rigorous, and subtle, and his vision of well-ordered science is very compelling.

Well-ordered science is not vulgar democracy, where all relevant parties get a vote and the majority rules. Kitcher is sensitive to the kinds of considerations which have drawn people to more elitist structures for regulating scientific inquiry. Instead of simple majoritarianism, well-ordered science embodies a decision process much like a family trying to make a collective decision about how to spend an evening together. "They begin with a number of different proposals, explaining to one another their preferences, the strength of the preferences, the considerations that move them. Each family member learns new things about the character of the various options, and each learns how the others view the possibilities." (p. 118)

The comparison between deliberation about scientific priorities and how a family will spend their evening together is, of course, rather simplistic. Kitcher is the first to acknowledge this, giving a sophisticated treatment of the kinds of deliberation that are required at each stage. The point of the analogy, however, is that there is a kind of democratic science that can avoid the tyranny of the ignorant. lt would proceed from an honest motivation to accommodate everyone's needs and desires as well as possible, allowing all members of society to have some say about the future of science.

While Kitcher would naturally want to see the policies of funding agencies conform to the standards of well-ordered science, he also sees his ideal as a model for reform of existing institutions. For example, well-ordered science envisions that representatives of the public will participate in ongoing deliberation about the future of science. This requires that the representatives have "tutored preferences". In other words, the representatives need to know something about the scientific field they are discussing and the relationship between basic research programs and potential future applications. Participating scientists, in turn, would need to learn more about the issues most important to the public. They would need to look long and hard at the ways in which their own research might severely hamper or greatly enhance the well-being of members of society.

However, we don't need to wait for the achievement of well-ordered science, to build institutions that foster these goals. Increased public understanding of the findings of the sciences and of the nature of scientific progress might be achieved through programs of public education. Similarly, existing funding structures might develop better means for assessing the impact of research areas on different segments of the population, bringing them closer to the ideal of well-ordered science.

So far I have only discussed the centerpiece of Kitcher's book, his theory of well-ordered science. There are many other fascinating discussions in the book. Several early chapters focus on a defense of scientific realism and objectivity. From there, Kitcher moves on to discuss free inquiry and its limits. Only then does he develop the theory of well-ordered science and consider challenges to his theory from various points along the political spectrum. He ends the book with an important chapter entitled "Research in an Imperfect World", where he discusses how significant parts of his theory might provide guidance in a world far from the ideal of well-ordered science.

From everything that I have written so far, one might think that Kitcher's book is completely abstract and written far removed from the concerns and research programs of working scientists. This is not actually the case. Kitcher was intimately involved with a committee charged with studying the ethical, legal, and social implications of the Human Genome Project. Large swaths of the book, including important chapters on the applications of his proposals for well-ordered science, are informed by his experiences with that project. This focus on the Human Genome Project, however, is likely to engender a reaction among chemists similar to mine when first reading the book: although complicated social structures might be necessary to guide research priorities for such socially complex areas of science as genomics, what about the areas of science that most chemists spend their time addressing? Must an investigator developing new asymmetric catalysts for organic synthesis be worried about achieving the ideal of well-ordered science? I am not sure that the book contains a direct answer to this worry, even though Kitcher's discussion does focus, probably by design, on some of the most contentious areas of scientific research. Yet he argues quite convincingly that we must all be vigilant in our efforts to understand the uses that might be made of our research in the future. Even when working in fields remote from the major concerns of a society, Kitcher argues, we must avoid adopting "a theology of science that would insulate inquiry against moral and political critique" (p. 182). Ultimately, science ought to be pursued to aid human progress and well-being. If a research project has even a remote potential to cause harm, we should work vigilantly to understand the risks and to mitigate them to the best of our ability. So I suppose that Kitcher's answer to the relevancy worry would be one of caution: are you really so sure, he might ask, that your research program has no potential negative impacts on society?

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Science, Truth, and Democracy is unparalleled in the literature and is likely to become the standard philosophical text about ethical issues in science. This book would be very useful for stimulating discussion in graduate student seminars and other kinds of scientific discussion groups. On the whole I recommend Kitcher's book to every reader of this journal and hope it will spark animated discussions, disagreements, and humane changes to chemistry and to science as a whole.

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Handbook of Heterogeneous Catalytic Hydrogenation for Organic Synthesis. By *Shigeo Nishimura.* Wiley-Interscience, New York 2001. 700 pp., hardcover $ 185.00.—ISBN 0-471-49698-2

Catalytic hydrogenation is a well established area and represents the most important application of heterogeneous catalysts in liquid-phase reactions. The handbook by Nishimura is intended for synthetic chemists in research laboratories and in industry, and focuses on the old and still timely problem of selectivity.

Many factors can influence the success or failure of a science book. A frequently underestimated parameter is the timing. The right timing was one of the reasons why G. C. Bond's book *Catalysis by Metals* became a bestseller: there was already enough information available for writing an exciting survey, but the exponential development of the field had not yet begun. This ideal moment is definitely past for heterogeneous catalytic hydrogenation. In the 1960s and 1970s many comprehensive books on the selectivity problem in catalytic hydrogenation of complex organic molecules appeared (from, for example, P. N. Rylander and R. L. Augustine, to mention only two among the many authors). Since then the available information has grown enormously. This interest is driven by the technical importance of heterogeneous catalytic hydrogenation in the environmentally benign synthesis of fine and specialty chemicals.

To be able to handle the amount of available information, most of the authors of recent books in the field limit the scope to some scientifically or technically attractive topics, rather than attempting to write a comprehensive review. However, Nishimura has chosen the classical approach and covered the hydrogenation of all important types of compounds and functional groups. In order to limit the length and provide a reasonable overview on the topic, he has focused explicitly on the experimental guidelines and mainly avoided the mechanistic aspects of catalytic hydrogenation. This approach is attractive for practical chemists who wish to search for the appropriate catalyst and reaction conditions. The handbook is a good starting point for finding a solution to a problem, or at least a useful analogy to start from.

The volume comprises 13 chapters covering the preparation of catalysts, typical reactors and reaction conditions, and—in greater detail—the hydrogenation of various types of functional groups. The text is illustrated by numerous schemes, equations, and tables. The special difficulties arising in the reduction of molecules possessing two or more reducible functional groups, and the stereochemistry of hydrogen addition, are also discussed.

Unfortunately, many of the methods described are quite old and some areas of recent interest are poorly represented. The overall impression left by reading the book is that no significant development has been achieved in the past 50 years except for some broadening of the scope of useful reactions. It is astonishing, for example, that the roles of modifiers, inhibitors, and poisons are discussed on the basis of Maxted's theory developed 50 years ago.

Similarly, the reader will find few literature references to new and highly effective hydrogenation catalysts. In the chapter describing typical catalyst preparation methods, most of the recipes are older than 50 years. It is fascinating to read this historical collection, but the practical chemist is well advised to buy commercially available materials produced by modern technologies.

Despite the shortcomings, the material is well presented and the handbook is rich in information. Compared to previous books in the field, this work offers a considerably better coverage of the Japanese literature. This, in view of the outstanding activity of Japanese scientists in fine chemicals catalysis, is gratifying.

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