

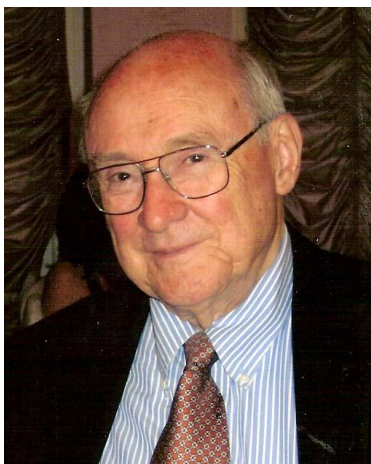
The CRC Handbook of Chemistry and Physics: A Mountain, a Cathedral, a Battleship, or ... an Iceberg?

Interview with David R. Lide, Editor-in-Chief of the *CRC Handbook of Chemistry and Physics*

By Svetla Baykoucheva

“Casting around the metaphors appropriate to the *CRC Handbook of Chemistry and Physics*, one considers mountains, cathedrals, battleships, and other massive things. The handbook, however, resembles none of these as much as it does an iceberg. Huge, impassive, largely unmaneuverable and mostly concealed, the *Handbook* and the iceberg both proceed on courses controlled by mysterious forces. A new Editor coming to the handbook, as does David Lide, might be expected to have feelings of awe, as well as helplessness. The size and impact of the *Handbook* are overwhelming, but the difficulty of achieving even minor perturbations on its progress must be downright intimidating.”

G. W. A. Milne (National Cancer Institute, National Institutes of Health)
Handbook of Chemistry and Physics, 71st ed. *J. Chem. Inf. Sci.*, 1991, 31 (1), 171-172.



For the past twenty years, Dr. Lide has been the Editor-in-Chief of the *CRC Handbook of Chemistry and Physics* and has been involved in several other reference book and database projects. After receiving a B.S in Chemistry from Carnegie Institute of Technology in 1949, he went to Harvard where he earned an M.A. in Physics (1951), and a Ph.D. in Chemical Physics (1952). Dr. Lide has served many institutions: President of the Committee on Data for Science and Technology (CODATA) of the International Council for Science, President of the Physical Chemistry Division of the International Union of Pure and Applied Chemistry (IUPAC), Chairman of the IUPAC Committee on Chemical Databases, Chairman of the American Chemical Society Task Force on Scientific Numerical Databases, Chairman of the AIP Publication Board (1979-80), Chairman of the AIP Planning Committee for the Physics Vade Mecum, and Councilor of the American Physical Society, representing the Division of Chemical Physics.

Dr. David Lide

Dr. Lide has served as a member of advisory boards of the Chemical Abstracts Service, Petroleum Research Fund, Engineering Information, Inc., National Materials Property Data Network, Chemistry Departments at Harvard and Princeton, as well as on panels of the National Academy of Sciences/ National Research Council. He was awarded National Science Foundation Senior Postdoctoral fellowships at University College London, in 1959-60, and the University of Bologna, in 1968-69. His awards include the Department of Commerce Gold Medal in 1969; the Samuel Wesley Stratton Award of NBS for research in microwave spectroscopy in 1969; a Presidential Rank Award of Meritorious Federal Executive in 1986; the Herman Skolnik Award in Chemical Information in 1988, and the Patterson-Crane Award of the American Chemical Society for Contributions to the Documentation of Chemistry in 1991. He was also designated a lifetime National Associate of the National Academy of Sciences, in 2003.

Dr. Lide is the author of several books (*Basic Laboratory and Industrial Chemicals*, *Handbook of Thermophysical and Thermochemical Data*, *Handbook of Organic Solvents*, and *Handbook of Data on Organic Compounds*) and is the editor of a commemorative book, *A Century of Excellence in Measurements, Standards, and Technology*, published on the centenary of the National Bureau of Standards (National Institute of Standards and Technology). He is also coeditor of the 2002 edition of *AIP Physics Desk Reference*, published by Springer Verlag. He has been involved the creation of electronic versions of the *CRC Handbook of Chemistry and Physics* and the database *Properties of Organic Compounds*.

Svetla Baykoucheva: *You recently announced that you will be retiring as editor-in-chief of the CRC Handbook of Chemistry and Physics, after being in this position for 20 years. Referring to the quote above, did you have such feelings as awe and helplessness when you became the editor of this “iceberg”? How did you become interested in this job and how have your education, professional experience, and interests helped you maintain such an extraordinary quality of this publication?*

David Lide: I do not recall feeling helpless when I became Editor in 1989, although it was clearly a big challenge. In fact, the book needed so much attention that I had the comfort of knowing that any change I made would be a noticeable improvement. The position was offered to me at a propitious time, when I was ready to take early retirement from NBS/NIST. It was a natural match to my background; my degrees were in chemistry, physics, and chemical physics, and I had spent 20 years in research in molecular spectroscopy, a field that straddles chemistry and physics. Also important was the time I spent as Director of the Standard Reference Data program at NBS/NIST. That program covered the full range of data from chemistry, physics, and material science, so I had at least a superficial knowledge of a great many areas of physical science. Finally, I had established the *Journal of Physical and Chemical Reference Data* as a joint venture of NBS, ACS, and AIP and had served as Editor for 16 years, so I had a fair exposure to the publishing business. I might add that, although I am retiring as Editor-in-Chief of the *CRC Handbook*, I will continue to be involved, especially with the electronic editions, for the next few years. I am pleased to be leaving the book in good hands with Mickey Haynes as the new Editor.

SB: *Could you tell us a little bit about the history of the Handbook? How was it conceived, and who were the enthusiasts who started it?*

DL: It is fair to say that the *Handbook of Chemistry and Physics* started as a marketing tool for the Chemical Rubber Company, a Cleveland company that sold tubing, stoppers, glassware, and rubber aprons to local high schools and colleges. The head of the company enlisted a chemistry professor from Case School of Applied Science (later morphed into Case Western Reserve University), William R. Veazey, to prepare a collection of reference data and recipes of interest to laboratory scientists. It amounted to 116 pages, followed by illustrated advertisements for the company's products. This first edition of the *Handbook of Chemistry and Physics* appeared in 1913 and sold for \$2.00. It was apparently successful enough to warrant a second edition in 1914, and the pattern of annual updates continued, with a few missing years, for the next 96 years.

As an amusing sideline, I invited Linus Pauling to write a Foreword for the *Handbook* a few years before he died. He described how he studied the *Handbook* in slack periods while he had a summer job during graduate school paving roads in Oregon. He attributed the beginning of his interest in chemical bonding to his speculations, from looking at *Handbook* tables, as to the reason for observed trends in physical and chemical properties.

SB: *What is the process of producing each new edition? How many people are involved in it? Which institutions make an input (intellectual or financial) in it?*

DL: As Editor-in-Chief I have had full responsibility for the content of the book – choice of topics, selection of data, and generation of the index. Each December, I send the new and revised sections, mainly in digital form, to CRC headquarters, where my files are converted to the CRC typesetting format. Their very efficient production group takes it from there, producing proofs for me to check and then assembling the old and new material to send to the printer. The books appear about six months after I submit the new material.

The new and revised tables come from two sources. First, I have assembled a group of experts in various fields who contribute to the book; about 30 of these are listed in the current edition, many from other countries. Some make a one-time contribution; others send regular updates every two or three years. I rely on the expertise of these contributors to select and evaluate the data, but I edit their submissions as needed to assure conformity to

international recommendations on units, symbols, terminology, and chemical nomenclature. Secondly, I personally produce and update a number of tables in areas of science that I am familiar with. For this purpose I draw heavily on evaluated data compilations published by organizations such as NIST, the International Union of Pure and Applied Chemistry, Government Agencies, and professional societies. The *Journal of Physical and Chemical Reference Data* and the reports from IUPAC projects are rich sources of high quality data. Here the main challenge is to select the most important compounds and materials from these very large databases, because space in the *Handbook* is always limited.

SB: *Being the editor of such a publication comes with a great responsibility, because so many scientists rely on the accuracy of the data in it. What is the process of verifying the data published in the Handbook?*

DL: Quality control is certainly a top priority, and I feel this is what distinguishes the *CRC Handbook* from the voluminous data sources that one can find, especially on the Internet. As pointed out in the previous answer, I use as much data as possible from secondary sources in which I have confidence, sources in which the data have been verified by going through a variety of tests such as those developed by the Standard Reference Data program at NIST. These tests include correlating all the available experimental data with theoretical models and applying statistical techniques to flag outliers and choose best values. All the outside contributors have extensive experience in carrying out measurements in the areas they represent, and I rely on their judgment. Whenever space permits I include references to data sources, which permits users to trace numbers they have questions about.

Much of the numerical data in the *Handbook* is archived in a database management system, which includes notes on the reasons for selection and for any changes made during a revision of a table. This system is also helpful in detecting keyboarding errors and inconsistencies between different tables – a flaw that is very annoying to users. For example, if a boiling point is given in kelvins in one table and degrees Celsius in another table, the software makes it easy to keep the two tables consistent. Also, I maintain a central database of preferred chemical names, formulas, and molecular weights, so that typos are minimized and names and other chemical identifiers are, with exceptions in special cases, kept consistent throughout the book. In spite of these efforts, users do report errors in the book, which provides valuable feedback. Many such reports are apologetic, pointing out that they really like the *Handbook* but just want to be helpful in reporting a typo.

This is a good point to thank the management, and the entire staff, of Taylor & Francis/CRC Press for their dedication to producing the highest quality publications. They have been totally supportive of all the changes I wished to make in the *Handbook*.

SB: *What were some of the boldest changes that you have made in the Handbook through the years? What were the biggest challenges in your career as its editor? Do you remember something unusual that you had to deal with or a moment when you had to make a decision that would later prove to be of critical importance for the publication?*

DL: When I became Editor, the book was in poor shape. It had grown considerably in size over the previous decade, but in a rather uncontrolled fashion. Some topics were duplicated in different parts of the book, other important topics were omitted. The contents were not organized in a logical way; the index was poor; and the typography varied widely. In my first edition I decided to take the book apart and reassemble the 350 plus tables in a coherent structure. So I created 16 sections covering areas such as Fluid Properties, Biochemistry, Nuclear Physics, Geophysics, etc., and I placed related tables together. I have kept this same structure, although I would probably do it a little differently today. When I restructured this first edition, I dropped many tables that seemed of little importance or were badly out of date. However, I failed to appreciate the diversity of the *Handbook* user community and received many complaints about the deleted tables. I quickly restored some of these after suitable updates. Of course, the creation of an electronic version has alleviated this problem. We have scanned over 50 of

the older tables and placed them in the Internet and CD-ROM editions; in the future, any table that is dropped from the print version will be kept in the electronic versions.

Other changes have been made in a more incremental fashion. In recent years I have broadened the coverage of topics outside the traditional areas of chemistry and physics, such as biochemistry and geophysics. I have added more general references to help guide users to data that do not appear in the Handbook, and have added an appendix listing web sites that contain reliable data. I have also added more redundancy to the index.

SB: *Could you tell us something about yourself—what your professional and personal interests have been? How did you balance your responsibilities for the Handbook with your working on other books?*

DL: Well, my professional career has been divided into three phases of roughly 20 years each – laboratory research, management, and publishing. I found research in molecular spectroscopy very satisfying; this period resulted in over 90 papers, many of which still get citations. Managing the Standard Reference Data program at NBS was satisfying in a different way. It led me to make contacts in many other fields of science, and I became heavily involved with international organizations such as IUPAC and CODATA. In the third period I was able to translate some of my previous experience into books and databases that I hope are helpful to the scientific community as a whole. Although the *Handbook* was my major task during this period, I was able to put out four other books for CRC Press, including the seven-volume *Handbook of Data on Organic Compounds* with Bill Milne. I also co-edited the *AIP Physics Desk Reference* in 2003, and in 2001 I edited a book commemorating the centennial of the founding of NBS/NIST.

SB: *The Handbook has been an indispensable resource for chemists, chemical engineers, and other professionals in related fields. How has the electronic format improved users' experiences?*

DL: Creation of an electronic version of the *CRC Handbook* has occupied much of my time since 2000. In bulk, the *Handbook* is tiny compared to classic print references such as Beilstein that have been converted to electronic form, but the diversity of the material in the *Handbook* presented a different kind of challenge. A large part of the chemical data in the book has been merged into a database format that provides the usual database functions – multiple types of searches, sorting, merging, and export. These capabilities enable the user to generate customized tables, avoiding the need to page through the book. I believe these features have been well received, although feedback is limited. There is still much work to be done, since each of the 351 tables has its own format, and a layout for nuclear physics is obviously very different from that for physical constants of organic compounds. So this is still a work in progress.

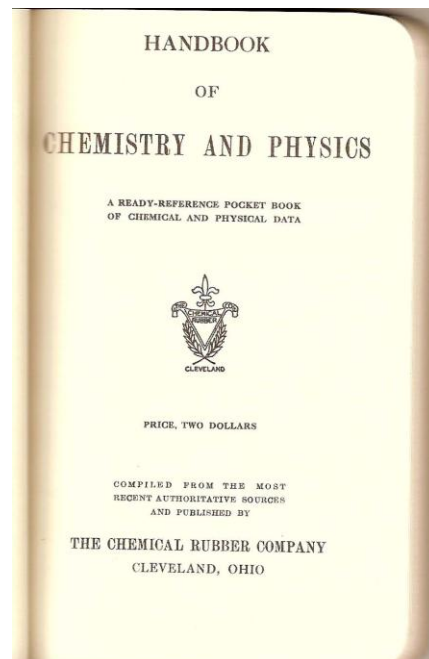
I expect to be at the Taylor & Francis/CRC booth at the ACS Washington meeting in August and will be happy to demonstrate the electronic version of the *Handbook*.

SB: *How is the Handbook competing with other resources such as CrossFire Beilstein, CrossFire Gmelin, SciFinder/STN, which also provide information about the chemical and physical properties of chemical compounds? For which questions would users rather go to the Handbook (print or electronic) than to these other resources?*

DL: I feel the *Handbook* serves quite a different need from massive databases such as Beilstein, Gmelin, the Cambridge Crystallographic Database, and the like. We cover an extremely broad range of properties and materials, and we try to focus on the systems that users are most likely to be interested in. We also tell the user where to look for further information if the question is not answered in the Handbook. Thus the Handbook, both print and electronic, is designed to be a convenient first entry point for anyone looking for information but not familiar with (or cannot get access to) the specialized information sources. This is the niche that the *Handbook* has occupied for almost a century, and we hope to maintain it.

SB: In your opinion, how will people find information about the chemical and physical properties of chemical compounds in the future?

DL: I may be in the minority in believing there will still be a place for the printed book into the indefinite future. The days of multivolume encyclopedic collections are gone, but I think there will still be a need for concise printed reference sources like the *Handbook*. Comprehensive databases on the Internet, such as the NIST Chemistry Webbook, will grow in size and usefulness, assuming the funding is available to allow free access. However, I have a real concern about the proliferation of unverified scientific data on the Internet. A Google search for any property of any chemical compound is likely to give thousands of hits, many of which are junk. Unfortunately, the high-quality sites like IUPAC and NIST usually fail to make it to the top on the list. Since students, even in junior high school, are now conditioned to use the Internet for everything, there is a pressing need to educate them on how to choose the most reliable sources.



Copy of the first edition of the CRC Handbook

SCHEDULE OF FUTURE ACS NATIONAL MEETINGS

238 th	Fall 2009	August 16-20	Washington, DC
239 th	Spring 2010	March 21-25	San Francisco, California
240 th	Fall 2010	August 22-26	Boston, Massachusetts
241 st	Spring 2011	March 27-31	Anaheim, California
242 nd	Fall 2011	August 28 - September 1	Chicago, Illinois
243 rd	Spring 2012	March 25-29	San Diego, California
244 th	Fall 2012	September 9-13	New York, New York