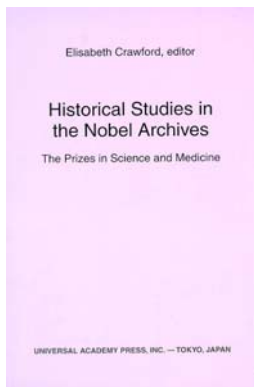


## Media Reviews

**Historical Studies in the Nobel Archives: The Prizes in Science and Medicine. Uppsala Studies in the History of Science, 31.** Elisabeth Crawford, Editor. Universal Academy Press: CPO Box 235, Tokyo, Japan 100-8691, 2002. Payment may be made by postal GIRO account (00160-8-177553), international postal money order, or credit card; email: [orderdpt@uap.co.jp](mailto:orderdpt@uap.co.jp); FAX: +81-3-3813-5932. Tables. vii + 161 pp; with CD-ROM; 14.4 × 22.2 cm. Paperback JPYen 3600; \$30.00; ISBN 4-946443-69-X.



The hallmark of the Nobel prizes, the *ne plus ultra* of awards in chemistry, physics, physiology or medicine, literature, peace, and economics, has been secrecy since the first prizes were awarded in 1901. However, in 1974 the Nobel Foundation inserted an addition to the paragraph (§10) in the statutes, which made a change in this policy:

A prize-awarding body may, however, after due consideration in each individual case, permit access to material which formed the basis for the evaluation and decision concerning a prize, for purposes of research in intellectual history. Such permission may not, however, be granted until at least 50 years have elapsed after the date on which the decision in question was made [1].

In 1975 Svenska Kungliga Vetenskapsakademien (the Royal Swedish Academy of Sciences), which was in charge of the prizes in physics, chemistry, and economics, was the first to grant permission to historians of science to consult materials in its Nobel archive for physics and chemistry. A small grant from the Nobel Foundation enabled Elisabeth Crawford [2] and Roy McLeod to carry out an exploratory survey, which dealt with the technical questions involved in making the archive more generally accessible and the specific studies in the history of science that might benefit from access to it by researchers. Their report, limited to the physics prize during the years 1901–1916, appeared in 1976 [3].

In *Historical Studies in the Nobel Archives: The Prizes in Science and Medicine*, Crawford, the first scholar to make extensive use of these archival materials, has edited a collection of recent works by an international group of historians of science in the Nobel archives of Svenska Kungliga Vetenskapsakademien (prizes in physics and chemistry) and Karolinska Institutet (the Karolinska Institute) (prizes in physiology or medicine). In her words,

The purpose of the present volume is not so much to celebrate the centenary [of the prizes] as it is to gather

under one cover the results of recent historical research in the Nobel archives (p vii).

Some of the eight essays in the book are revised and expanded versions of work published earlier elsewhere.

- “Introduction: 25 years of research in the Nobel archives” by Elisabeth Crawford (17 pp) reviews the research carried out in the three problem areas presented in the 1976 report [3]—studies exploring the international and institutional significance of the Nobel institution, the prize and the history of late nineteenth and early twentieth century physics, and the Nobel population [4]—as those most likely to attract historians of science to the archives. She also discusses the benefits of the access to the history of science and the Nobel institution, and she concludes that the main beneficiary of the opening of the archives has probably been the Nobel institution itself.
- “The Nobel science prizes of World War I” by John L. Heilbron (20 pp) [5] demonstrates that the extraordinary circumstances of the wartime prizes opens a door to the otherwise secret proceedings of the committees that recommend prize winners to the academy. Although the academy should not consider religion, politics, or nationality, these considerations come into play, especially during wartime. Heilbron examines the nominations for the physics and chemistry prizes between 1914 and 1919. He explores in particular the case of Fritz Haber, whose use of poison gas led many to consider him a war criminal, and he explains why all but one of the physicists and chemists who gathered in Stockholm in 1920 to receive the prizes that they had won during or immediately after the First World War were Germans.
- “Niels Bohr and the Nobel Prizes” by Finn Aaserud (26 pp, the longest essay) [6] maintains that the decision to award Bohr the 1922 physics prize can only be understood in the light of his relationship with the Swedish physics community, particularly with Carl Wilhelm Oseen, who championed Bohr, Einstein, and theoretical physics, which had previously been neglected in favor of experimental physics. After 1922 Bohr’s field in general and Bohr in particular influenced the Nobel institution more than vice-versa.
- “Scientific recency: George de Hevesy’s Nobel Prize” by Gabor Pallo (14 pp) details how Hevesy’s prize was unusual in that he was nominated 13 times between 1924 and 1944, first for his discovery of the element hafnium and later for his work on the use of radioisotopes as tracers, for which he eventually received the chemistry prize—in 1943. In this case the committee interpreted Hevesy’s work as recent since the medical and biological applications of tracers had not become immediately obvious.
- “Moniz, lobotomy, and the 1949 Nobel Prize” by Carl-Magnus Stolt (15 pp) [5] is a medico-historical analysis of this complex interdisciplinary ethical and philosophical case. The Portuguese physician Antonio Egas Moniz (1874–1955) received the prize in physiology or medicine for his technique of prefrontal lobotomy, a procedure that was later strongly condemned. Stolt argues that

contributions should be evaluated in the context of their time, and he reminds us that blood letting was once a universally accepted medical therapy.

- “Why did Freud never receive the Nobel Prize?” by Carl-Magnus Stolt (11 pp, the shortest essay) [5] examines the nominations of Sigmund Freud (1856–1939) over almost a quarter-century (1915–1938) and the evaluations of his work in the context of the reception of his work by Swedish psychiatrists, especially the then most prominent of these, Bror Gadelius. The archival documents do not reveal anything to indicate anti-Semitism or political concerns (possible fear of antagonizing Nazi Germany). Stolt concludes that the principal reason for not awarding Freud the prize lay in scientific method and tradition, that is, in science versus the humanities. Although Freud rejected the criticism that psychoanalysis involved speculation and suggestion, he will be regarded as “one of the first who looked beyond strictly natural-scientific medicine” (p 104).
- “Katsusaburo Yamagiwa’s Nobel candidacy: Physiology or medicine in the 1920s” by James R. Bartholomew (25 pp) [7] explores the candidacy of Yamagiwa, who had developed the world’s first efficient method for producing cancer artificially in the laboratory by swabbing coal tar on rabbits’ ears, which had stimulated activity among cancer researchers worldwide. Johannes Fibiger of Denmark, who discovered how to use parasites to cause cancer in rats two years before Yamagiwa’s achievement, received the prize, probably because nominations were often greatly influenced by acquaintanceship, geography, and the marginalization that distance from other centers imposed on the Japanese.
- “Neighbouring Nobel: A look at the Danish laureates” by Henry Nielsen and Keld Nielsen (22 pp) argues that the truth about Nobel prizes is often replaced by simplified myths or nonsensical stories by the time that the account of the laureates’ achievements reaches the media. The authors cite the intense press coverage of the 1997 award to Jens Christian Skou [8], which resulted in the establishment of a Danish research project to provide a historical analysis of the work, people, and stories behind the 13 Nobel prizes (all fields except economics) that had been awarded to Danes with the goal of drawing lessons from the complex histories of the Danish laureates. In collaboration with 13 historians of science the Niensens served as authors and editors of the book summarizing the project [6], which concurred with the findings of recent international research into the history of the Nobel Prize such as that of Elisabeth Crawford and Robert Marc Friedman [9] that decisions of the Nobel committees “were influenced by what they themselves considered important in those fields” and Harriet Zuckerman’s contention that one of the best strategies for winning a prize is to become a student, postdoctoral fellow, or collaborator of a laureate [10]. The Niensens focus on four themes—contingent versus inevitable prizes; Danish laureates on the periphery; A Nobel Prize is no guarantee against being forgotten; and two embarrassing scientific prizes? (Nils Finsen and Johannes Fibiger, physiology or medicine, 1903 and 1926, respectively).

The essays in the book demonstrate the preponderant role of the Nobel committees for physics, chemistry, and physiology

or medicine in the decisions concerning the prizes, how the problematic aspects of Alfred Nobel’s will and the statutes of the Nobel Foundation—in particular, the clauses regarding the recency of the work to be rewarded and its benefit to mankind—have been given varying interpretations depending on time and circumstances, and the scientific, historical, and political contexts of decisions to award or not award the prize to a given person. The book will be indispensable for historians and sociologists of science and anyone interested in the Nobel Prizes and the process by which they are awarded.

## References and Notes

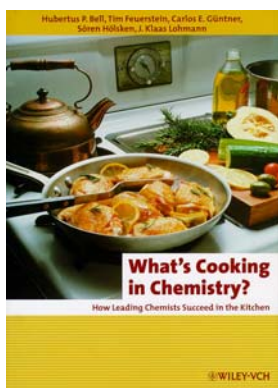
1. <http://nobelprize.org/nobel/nobel-foundation/statutes.html#par10> (accessed Nov 2005).
2. For biographical data on Crawford and a list of her most important works see Kauffman, G. B. *Chem. Educator* **2005**, *10*, 406–407; DOI 10.1333/s00897050958a.
3. Crawford, E.; McLeod, R. *The Nobel Prizes in Physics 1901–1916: A Report on Archival Materials*; Paris, France; Brighton, England, 1976.
4. Crawford, E.; Heilbron, J. L.; Ullrich, R. *The Nobel Population 1901–1937: A Census of Nominees and Nominators for the Prizes in Physics and Chemistry*; Office for the History of Science and Technology: University of California, Berkeley; Berkeley, CA; Office for History of Science, Uppsala University: Uppsala, Sweden, 1987 (paperback). For a review of the updated version, Crawford, E., Compiler. *The Nobel Population 1901–1950: A Census of the Nominations and Nominees for the Prizes in Physics and Chemistry. Uppsala Studies in the History of Science, 30*; Universal Academy Press: Tokyo, Japan, 2002 see Kauffman, G. B. *Chem. Educator* **2005**, *10*, 406–407; DOI 10.1333/s00897050958a.
5. This essay is a revised and expanded version of an article published in 100 Ans de Nobel—Dans les Couloirs du Prix. *Les Cahiers de Science et Vie* **December 2000**, *60* (in French).
6. This essay is a shortened version of Aaserd’s article, Niels Bohr (1922): ‘I know how little I have deserved this...’ In *Neighbouring Nobel: the History of Thirteen Danish Nobel Prizes*; Nielsen, H.; Nielsen, K., Eds.; Aarhus University Press: Aarhus, Denmark, 2001; pp 272–312.
7. Sections of this article originally appeared in Bartholomew’s article, Japanese Nobel candidates in the First Half of the Twentieth Century. *Osiris* **1998**, *13*, 238–284.
8. Skou shared half the prize “for the first discovery of an ion-transporting enzyme, Na<sup>+</sup>,K<sup>+</sup>-ATPase” with Paul D. Boyer and John E. Walker “for their elucidation of the enzymatic mechanism underlying the synthesis of adenosine triphosphate (ATP).” For details see Kauffman, G. B.; Kauffman, L. M. *The Biochemistry of Life’s Energy*: Boyer, Walker, and Skou received the 1997 Nobel Prize for Chemistry for their “pioneering work on the enzymes that participate in the conversion of the ‘high energy’ compound adenosine triphosphate (ATP).” *Chem. Educator* **1999**, *4*, 28–39; DOI 10.1333/s00897980274a.
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10. Zuckerman, H. *Scientific Elite: Nobel Laureates in the United States*; 2nd ed.; Transaction Publishers: New Brunswick, NJ, 1996; pp 96–143.

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**What's Cooking in Chemistry? How Leading Chemists Succeed in the Kitchen.** Hubertus P. Bell, Tim Feuerstein, Carlos E. Güntner, Sören Hölsken, and J. Klaas Lohmann, Eds. Wiley-VCH GmbH & Co. KGaA: Weinheim, Germany, 2003. Illustrations, figures. xi + 232 pp; 17.7 × 24.4 cm. \$42.00; £22.50; €29.90; SFR45.00; ISBN 3-527-30723-0.



This volume is a unique *Festschrift* presented as a tribute to Professor Lutz Friedjan Tietze (b. 1942), the eminent organic and natural products chemist at the Georg-August-Universität Göttingen with some 320 articles and 22 patents to his credit, by five members of his research group on the occasion of his 60th birthday. Most *Festschriften*, volumes in honor of a colleague on an important anniversary, consist of articles or essays contributed by many authors, but this is the first one that we have seen that consists of recipes.

Chemistry and cooking are both experimental sciences. The idea for this cookbook arose from the old tradition in the group in which everyone has to prepare an assortment of cakes for the others for Tietze's birthday. The editors invited a number of well known, award-winning chemists from around the world to participate in the project, and they received answers from 56 of these professors, who sent them 58 recipes, often accompanied by some personal remarks about why they chose this particular one. Their contributions, alphabetically arranged according to author, deal with a wide variety of culinary delights such as soups, salads, meat, fish, seafood, sweet dishes, and even a potent punch "recommended for a party night," "The 1:1:1 Mix" (pp 163–165) [1], from Herbert W. Roesky, the sole inorganic chemist among what amounts to a "Who's Who" of organic chemists. The recipes are presented along with one-page biographical sketches and portraits (some with wife and children), each accompanied by summaries of the research work and interests of each contributor, complete with structures, reaction schemes, figures, and references "that might be interesting to read during the possible waiting times in the kitchen."

The recipes include a list of ingredients and their amounts as well as the number of persons that the dish serves. In most cases the recipe is followed by a commentary on the recipe, the reason for its choice, or general history by the contributor, ranging from a single sentence to two pages ("Essential Information about Bologna"—pp 195–196—which follows "Lasagna Verdi" by Claudio Trombini—pp 193–194). Amusing anecdotes and Internet web sites, for example, pp 196 and 207, are sometimes provided. Many of the contributors suggest the kinds of wines or beverages to accompany the dishes.

The book's subtitle is somewhat of a misnomer in that all of the recipes do not originate from the chemist contributors themselves; some are from wives, mothers, family members, or colleagues. The most prominent chefs are men, and recipes by only three female chemists are included: Marye Ann Fox ("Carolina Dirt Cake," pp 59–61), Robin L. Garell ("Ahi Tuna Sashimi Napoleon," pp 67–71, with Kendall N. Houk), and Hiriyyakkanavar Ila ("Domino Chicken Curry," pp 105–108).

Professor Tietze himself, who is being honored in this *Festschrift*, contributed one recipe ("Pork Roulades with Cheese," pp 187–189). His daughter is the one preparing a delicious sauce for her father's favorite dish on his birthday, and his wife, who provides the commentary, quotes him as saying:

Cooking is like chemistry. A chemist has to put himself into the position of the molecules. Then he knows what such a molecule wants and how it reacts. Now he is able to understand the reaction. You have to do so in the kitchen, then you can be sure that everything succeeds (p 189).

In deference to Tietze [2], two of the recipes include the word "Domino" in their titles—"Domino Cake" by Cesare Gennari (pp 73–75) and the previously mentioned "Domino Chicken Curry" (pp 105–108). Similarly, two of the contributors name dishes in honor of their sons—"Farfalle with Artichoke Cream Alessandro" by Donald Hilvert (pp 93–96) and "Filled Peppers à la Benjamin" by Axel Zeeck (pp 227–229).

The recipes range in complexity from "Dulce de Leche" (pp 205–207) (simply simmered condensed milk heated in the can; the only recipe to include a safety warning) by K. Peter C. Vollhardt to a three-course meal "A Crustacean Catastrophe," "Tenderloin of Wild Boar," and "Royal M&M Almond Cake" (pp 109–114) by Karl Anker Jørgensen. The wild boar recipe (p 112) was particularly intriguing to us. One of our sons-in-law, Flip Baron, is an avid hunter of wild boar in California's coastal mountains. When his hunt is successful (Wild boar are fierce fighters.), he dresses the meat and processes most of it into sausages. Jørgensen's recipe seems like a wonderful way to feed a large crowd, and our family of 25 or so could be amply fed, and with the participation of a few musicians in our brood, we could indulge in a Viking banquet (Jørgensen mentions that his Viking forebears favored boar) [3]. Another exotic recipe is the first in the book—"Marinade for BBQ Kangaroo" (pp 1–3) by Martin Banwell—of the Australian National University—where else? At first we were surprised that Kyriacos C. Nicloaou's contribution was not a Greek dish but was "Fish & Chips" (pp 147–150) until we read:

This little recipe has sentimental value to me, since I learned it long before I became a synthetic organic chemist—during my struggles for survival in England as a student and a fish & chips chef. The accompanying photos will remind you of me then and now (p 150).

Robert G. Bergman and Horst Kunz submitted similar recipes, the former "Potato Latkes (Potato Pancakes): A Traditional Chanukah Dish" (pp 5–7) and "Arzgebirg'sche Schusterklieb" (pp 123–126), respectively. Both dishes involve potato, egg, onion, flour, salt, and pepper fried in oil. We've prepared latkes for many years for family and friends as a traditional holiday repast, served with sour cream and applesauce [4]. Another dish in which we have a personal interest is "Scott's Fondue" by Scott E. Denmark (pp 37–39) [5].

Although most of the contributors do not discuss the chemistry involved in their recipes, several do. For example, Martin Suhm, in his "Fish Souffle Clausius–Clapeyron" (pp 179–181), tells us:

According to Gay-Lussac's Law for the air and the Clausius–Clapeyron Equation for the steam, the bubble size increases and the soufflé gains the double or trifold volume and possibly becomes more stable. Nevertheless the soufflé should be served immediately after preparation because Gay-Lussac's Law and the Clausius–Clapeyron Equation are still valid while cooling down (p 181).

A number of the contributors share romantic personal reminiscences. For example, Armin de Meijere, who submitted "Spaghetti con 'Schluntz'" (pp 33–36), relates:

I was even able with this main course to impress my then-new girlfriend Ute Fitzner, who four years later became my wife. One may also consider this protocol as an early example of the "combinatorial kitchen," since all ingredients may be varied in their ratio so that the corresponding product will be obtained with vastly different taste. Thus, the given quantities will assemble only one example of a whole library of taste profiles (p 36).

All of the recipes are given in terms of the metric system, but a conversion table between this system and the imperial system and between Fahrenheit and Celsius temperatures as well as a note on American standard measurements are given. The short (2-page) index is classified according to Fish, Meat, Miscellaneous, Soups, Sweet dishes, and Vegetables, under which the recipes appear in alphabetical order.

Although other books on the science of cooking [6–8] and collections of recipes by chemists and physicists on the Internet [9] are available, this volume is a welcome addition to the genre, and we recommend it to nutritional scientists, food technologists, cooks, "foodies," and chemists interested in foods and their preparation. Its modest price makes it a perfect gift for such persons.

## References and Notes

1. This book is liberally laced with humor by a number of the contributors. For example, according to Roesky, "This quantity is supposed to be for 3 people. The effect is quite interesting....You will stay clear-minded, which leads to high-level conversations. But it could happen that the legs become heavy. Let's say the legs cannot be moved normally, they weaken. Therefore, close-by sleeping opportunities should be arranged. Prosit!" (p 165). Other examples of humor related to  $C_2H_5OH$  include "Ley's Low-Calorie, Chemical-Free Risotto?" (pp 131–133) by Steven V. Ley and "Fruitcake" (pp 171–173, a recipe from the Internet) by Lawrence T. Scott. Both contributors intersperse recipe directions with instructions to drink copious volumes of alcoholic beverages. They end their contributions with "Enjoy with a glass of wine if there is any left!" and "Check the whiskey again. Go to bed. Who the hell likes fruitcake anyway?," respectively.
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3. Wild boar is also mentioned in Herbert Waldmann's commentary, "Italian Cuisine—A Personal Confession" (pp 212–213).
4. Kauffman, G. B.; Kauffman L. M. Appetizers: Tips for Making Cooking Easy: My Favorite Dish: Recipes from Our Readers: Celebrations brighten the holidays [Potato Latkes], *Fresno Bee*, November 25, 2002, p E3.
5. Kauffman, G. B.; Kauffman, L. M. Appetizers: Tips for Making Cooking Easy: My Favorite Dish: Recipes from Our Readers:

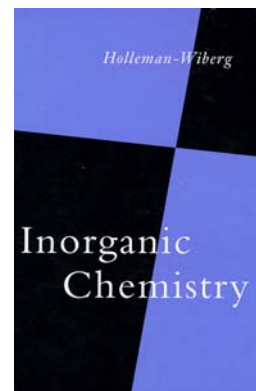
Fondue, once again a hot dish, goes way back. *Fresno Bee*, January 10, 2001, p E3; Chemistry and History: Swiss Cheese Fondue: Chemistry in the Kitchen. *Chemical Educator* **2001**, *6*, 385–388; DOI 10.1333/s00897010512a.

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9. Christiane's Collection of Cooking Recipes of Chemists and Physicists (in English). [http://chris\\_fra.tripod.com/recipes](http://chris_fra.tripod.com/recipes); Die Kernchemie Küche (in German); <http://dkemcz.chemie.uni-mainz.de/kueche/kueche.htmlx>. Christiane Franz's email address is: [chrisfra@yahoo.com](mailto:chrisfra@yahoo.com).

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**Holleman–Wiberg Inorganic Chemistry. First English Edition.** Nils Wiberg; translated by Mary Eagleson and William Brewer; revised by Bernhard J. Aylett. Academic Press: San Diego, CA; Walter de Gruyter: Berlin, Germany; New York, NY, 2001. Figures, tables. xxxix + 1884 pp, 18.3 × 25.4 cm. Hardcover, \$204.95; ISBN 0-12-352651-5.



In 1898 the first edition of this popular text, written in Dutch by Prof. Arnold Frederik Holleman (1859–1953) of the University of Groningen, appeared in the Netherlands [1]. It was translated into German in 1900 [2], and in this version it soon became a classic throughout the German-speaking world because of its unparalleled comprehensiveness and detailed coverage of all aspects of inorganic chemistry. Holleman continued as author through 17 editions (1900–1927), while E. H. Büchner took over the task for the 18th and 19th editions (1930 and 1937). Under the authorship of Egon Wiberg (20th to 32nd editions, 1901–1976) it became a bestseller known as the "Bible of Inorganic Chemistry." Since the 33rd edition (1985) Nils Wiberg (b. 1934) of the Institut für Anorganische Chemie of the Ludwig-Maximilians-Universität München has been in charge of this valuable continuing compendium, colloquially and affectionately known as "Holleman–Wiberg" much as other standard works such as Gmelin, Beilstein, and Ullmann are known by the names of their authors or editors.

The book under review here is an English translation of the 34th edition (101th printing, 1995) [3]. Although it is advertised as the first in English, this claim is not quite true. It is the first English translation of the German edition, but the original Dutch edition [1] was translated into English in 1902 [4] and went through a number of editions. However, because in the United States inorganic chemistry languished in the doldrums until its renaissance after the close of World War II [5], such long texts as this one, which is in the tradition of the extensively detailed German *Handbuch*, found little adoption in the USA, where inorganic chemistry was dealt with in general chemistry courses rather than in separate advanced courses.

This revised, expanded, and extended English translation is massive, weighing almost five pounds. As the single most comprehensive inorganic text available, it dwarfs any possible competitors in both sheer volume and depth of information. It reminds me of Nevil Vincent Sidgwick's monumental treatise [6], which I purchased as a "must-have" for a young aspiring *Inorganiker*, but it is not only a reference book but a teaching text as well. Because it is printed in relatively small type on very thin paper, its contents are even greater than might be thought from the number of pages.

Like previous editions, it is designed for both beginning and advanced students as well as chemists and scientists in fields related to chemistry. Once again, it presents both the theoretical fundamentals of inorganic chemistry and considerable descriptive inorganic chemistry. However, additional areas of science and numerous topics of current chemical interest are included, resulting from a large number of completely new chapters and sections, additional paragraphs, 164 tables, 359 figures, and formulas. For example, all the chapters and sections on coordination and organometallic compounds as well as solid-state chemistry have been augmented, and the finished product now provides equal coverage to all branches of inorganic chemistry, making it particularly useful for students studying for examinations. Literature references as late as 1994 (the year before the date of the German edition) permit the reader to explore further current topics in greater depth.

Even though many sections of the 33rd edition (1985) were streamlined and reorganized and much material was deleted as inessential or outdated, the 34th edition from which this English translation was prepared was much longer than the 33rd because of the more balanced treatment of all areas of inorganic chemistry. Nevertheless, the new edition is still more compact than a combination of an introductory theoretical textbook and an advanced descriptive text, which would be needed to provide comparable coverage. Most of the increased length is due to three new chapters of general information—Chapter XIX, "Transition Elements (Outer Transition Metals), the Periodic System of the Elements (Part III), a Comparative Overview of the Transition Elements" (pp 1127–1138); Chapter XX, "Fundamentals of Complex Chemistry" (pp 1139–1222); and Chapter XXI, "Some Fundamentals of Solid-State Chemistry" (pp 1223–1247). Also, additions to the appendices, literature references, and numerous new figures, formulas, and tables increased the length.

As an aid to beginners two sizes of print are used—important information (large print) and advanced material (small print). Furthermore, the text is organized into main sections, subsections, and sub-subsections, and boldface and italic types are extensively used to emphasize the most

essential information and to facilitate location of specific material. The numerous cross-references and the organization of the text make the chapters self-sufficient so that in most cases any chapter may be read without extensive knowledge of other portions of the book. The many new summaries should make it easier for students to prepare for examinations, and they provide a quick orientation for them to seek out new areas. A name index (five 3-column pages) and an extremely detailed subject index (108 3-column pages) make the volume user-friendly. Also, the data banks in the appendices (Part E, 24 pp) and in the prefatory sections (tables) present important data on the elements at a glance.

As in previous editions, the volume is divided into four main sections and six appendices. Part A, "Fundamentals of Chemistry" (pp 5–275), inductively presents the concepts of atoms, protons, electrons, neutrons, and molecules in connection with the separation of chemical compounds into progressively simpler components. After introducing the fundamentals of the periodic system, a deductive approach demonstrates how chemical compounds are built up from atoms and molecules. The concepts of chemical equilibrium and redox and acid–base reactions and their applications to the compounds of hydrogen conclude this part.

Part B, "Main Groups of the Periodic System" (pp 227–1124, the longest part), systematically deals with the 44 elements of the eight main groups in which the outermost electron shells are filled. Part C, "Transition Elements" (pp 1125–1638), deals with the 40 outer transition metals in which the next-to-outermost electron shells are filled. Part D, "Lanthanides and Actinides" (pp 1639–1738, the shortest part), describes the 28 inner transition metals in which the second-to-outermost electron shells are filled. Each of these parts begins with a general chapter on the periodic system—first the shortened form containing only the main group elements is presented, then the transition elements are added, and finally the lanthanides and actinides are incorporated into the complete system. Also, comparative overviews of important properties of the elements and chapters on general topics—fundamentals of molecular, complex, solid-state, and nuclear chemistry—which deal with questions of atomic and molecular structure, the chemical bond, chemical reactions, stereochemistry, complex formation, and natural and artificial transmutation of the elements—are included. Part C concludes with a summary, Chapter XXXII, "The Compounds of Transition Metals: A Comparative Review" (hydrogen, halogen, oxygen, nitrogen, and organometallic compounds, pp 1530–1638).

*Inorganic Chemistry* is an authoritative and comprehensive textbook and reference source for undergraduate and graduate students, chemists, and scientists working in chemistry-related fields such as physics, biology, geology, pharmacy, food chemistry, and medicine. A time-tested tome that has been refined for a century and has been used through the years by students and professionals alike, it contains all the material needed by the above audiences in precise detail in one volume.

## References and Notes

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**The Comprehensive e-Book of Named Organic Reactions and Their Mechanisms, 2nd Edition.** By Elbertus Kruiswijk. Emedia, 2005. 1976 pp, 8.26 MB, \$50. ISBN: 0-9544302-1-2. Available at <http://www.chemistry-software.com/>

There are numerous organic chemistry books on the market dealing with named organic reactions and reagents. This is for good reason, because a named reaction by itself usually supplies enough information to describe an organic transformation and its mechanism quickly and completely to an educated audience. As the title of this e-book indicates, this is comprehensive and by the number of pages (1976), named reactions (1308), and references (>7000) I would have to agree.

The author has divided each reaction into the following categories: example, mechanism, disconnection, notes, references, and comments. The example provides a reaction scheme that is suitable for the general reaction. In the mechanism section the readers should not expect a complete mechanism but the major intermediates and sometimes several curved arrows. The disconnection section contains a retrosynthetic scheme for the named reaction. The notes section gives a short description and is where you will find the “see also” sentence for related named reactions. The references include citations to reference books (March, Smith–March, Houben–Weyl, Org. Synth., etc.) and then literature references in chronological order. The comments section is blank space for the reader to add their own notes, but unfortunately the security setting for this edition does not give the owner permission to add these notes into the e-book.

This e-book can be browsed using Adobe Acrobat (the author has recommended version 7.0 for the pdf document). The most important advantage of the e-book format for this type of comprehensive work is that the file can be efficiently searched for any word or phrase, including names. The author advises, and I agree, that if you know the name for which you are looking, then the index (pp 1949–1975) is the place to look. When searching for keywords such as ketone (316 instances), radical (88 instances), and nitrile oxide (4 instances) or names such as Corey (237 instances), Sharpless (52 instances), or Grubbs (8 instances), you can quickly double-click through each of the instances, scan, and retrieve the needed information or references. Do not forget that you can search fragments such as “reduc” which will find instances

for reduction, reductions, reductive, reduces, reduced, and reducing (total instances found: 263).

From the Abramov phosphorylation reaction to the Zinovev–Soborovski reaction, this book includes more than other named reaction books or databases I have read or seen. I have attempted to do some research to verify the completeness of this named reaction e-book. After examining every 50th page in *Name Reactions and Reagents in Organic Synthesis*, 2nd ed.; Mundy, B. P.; Ellerd, M. G.; Favalaro, Jr., F. G. Wiley: New York, 2005, I found that all these random reactions were included in this e-book. I also examined the named reactions from student presentations given in the advanced organic chemistry course at Ball State University over the past two years and again, all were accounted for in this e-book. It should be remembered that this e-book includes only those reactions named after people. This second edition has been expanded and updated through the current literature for the week of August 15, 2005. Besides edits, corrections, and the newly added beginning of chapter indexes from the 1st edition, there is substantial new material and some new reactions. Searching this edition has found 98 references to articles from various journals published in 2005.

In my opinion, because this is an e-book and actual pages are not a major concern, it would be beneficial to have each new reaction start on the top of a new page. Another minor point is that the cover page of the e-book is not numbered but counts as a page in the document. The listings in the chapter indexes and final index all state the pages of the book as one less than the page of the document. With almost 2000 pages to scroll through, I have to type in the page number from the index but then have to scroll down one more page to find the reaction in the document. More thorough mechanistic details would make this comprehensive e-book of named organic reactions and their mechanisms a valuable pedagogical tool.

This e-book should be very beneficial to the well-trained organic chemist as an easily searchable reference tool. Another advantage of the e-book format is the price, which makes it affordable for scientists to have a copy on their computer. I am pleased to recommend this e-book to advanced organic students, researchers utilizing organic chemistry, and chemical educators for ideas in research and teaching.

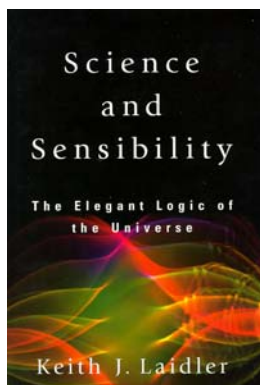
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**Science and Sensibility: The Elegant Logic of the Universe.**

Keith J. Laidler. Prometheus Books: Amherst, NY, 2004. Figures, illustrations. x + 233 pp; 15.5 × 23.4 cm. \$28.00; ISBN 1-59102-138-3.



During the last years of his life Keith J. Laidler (1916–2003) [1], Professor of Chemistry Emeritus at the University of Ottawa, recipient of the 1996 Dexter Award in the History of Chemistry and other honors, and author of textbooks on kinetics and thermodynamics from which chemists of my generation learned physical chemistry, wrote no less than three books on science for the general reader [2, 3], of which *Science and Sensibility* is the last.

Although Laidler does not present his rationale for the title of his book, the similarity to Jane Austen's first published novel, *Sense and Sensibility* (1811) [4], the theme of which is the need for finding a workable balance between passion and reason, should be obvious. Austen's book revolves around the striking contrast between the Dashwood sisters, Elinor and Marianne; the former is a sensible, rational woman of common sense, whereas the latter is endowed with a wildly romantic sensibility. Austen admires Elinor and argues that a truly happy marriage exists only where sense and sensibility are properly integrated. Similarly, the theme of *Science and Sensibility* is the contrast between the judicial and the intuitional ways of evaluating evidence and reaching decisions with Laidler's advocacy of the former.

To see a World in a Grain of Sand  
And a Heaven in a Wild Flower  
Hold Infinity in the palm of your hand  
And Eternity in an hour [5].

Laidler explains his use of these lines:

The quotation at the beginning of this book may appear surprising, since William Blake rather disliked and despised science. He intended his lines to lead to mysticism, but today they could lead us toward a life of intellectual adventure, in which we do our best to understand the mysteries of the wonderful universe around us. The mystic accepts and enjoys these mysteries. The scientist enjoys them just as much, and perhaps more and more as the great veil of ignorance is gradually lifted by the advance of science. This book tries to sustain our sense of wonder as we explore our understanding of nature (p 11) [6].

Much of the huge information explosion in the media and the Internet that barrages us every day with data that is both trivial and profound has been produced by science and technology. Laidler asks the question:

How should we cope with the vast amount of information, about science and other matters, that confronts us daily? People seem eager to acquire information, but are less concerned about what they should do with it. Many spend time exploring the information highway. This can be a useful and timesaving activity, but far from being an end in itself, information is only the lowest rung of the intellectual ladder. Above it there is knowledge, which results after our brains have carefully selected information in an appropriate way, and have processed it into a coherent point of view. Beyond that, we hope, is wisdom (p 9).

In *Science and Sensibility* Laidler seeks to provide a thorough grounding in science literacy for the general layperson, a goal that, in my opinion, he has successfully achieved. He thinks that it is

useful for all of us to have a clear understanding of the methods and influence of science. That is not the same thing as saying that everyone needs an extensive scientific education. After all, we can enjoy and appreciate music without being able to play or even read a note of it. So it is with science: since science and technology so dominate our everyday lives, we should try to understand and appreciate what science is about (p 9).

In Chapter 1, "To Tell the Truth" (9 pp), Laidler discusses these goals, the various methods for handling information, which he considers a collection of facts, errors, and meaningless statements, and why what he calls the judicial method is the best way of evaluating information and reaching decisions from it. To make his book more accessible to nonscientists, in the next four chapters he presents a simplified, relatively brief view of science, illuminating the relationship between its various branches and showing how they lead to a unified conception of our place in the universe. He reviews the basic concepts of chemistry, physics, astronomy, geology, and biology and shows how evidence from these sciences leads to a logical, consistent view of the formation and development of our universe and of life within it.

In Chapter 2, "The Nuts and Bolts" (25 pp), Laidler focuses on the methods of the most basic of the hard sciences—chemistry and physics. After mentioning several cases of incorrect scientific information (René Prosper Blondlot's "N-rays," Harold Baily Dixon's "intensive drying," and B. Stanley Pons and Martin Fleischmann's "cold fusion"), he considers empirical laws such as Boyle's, Gay-Lussac's, and Ohm's laws, principles such as the laws of thermodynamics and the concept of relativity, and he clearly distinguishes laws from theories and hypotheses. *Inter alia* he deals with Occam's Razor, entropy, perpetual motion, Maxwell's demon, and the ether as well as figures such as Francis Bacon, Sir Isaac Newton, James Clerk Maxwell, Guglielmo Marconi, and Lord Kelvin. Throughout the book he identifies every person by nationality and profession, and in most cases he gives their birth and death dates.

Chapter 3, "The Ingredients of Our Universe" (42 pp, the longest chapter), presents the three distinct features upon which the universe has been established: (1) the fundamental particles of which all matter is composed, (2) energy, and (3) the basic, universal laws of nature. In so doing, Laidler discusses atomic theory; protons; electrons; neutrons; valence; isotopes; radioactive disintegration; kinetic, potential, chemical, light, and electrical energy; atomic mass units; nuclear fission and fusion; nuclear bombs; Einstein's theory; quantum theory; electromagnetic radiation; quantum and wave

mechanics; the uncertainty principle; chaos theory; fractals; and positive feedback. He also considers the contributions of numerous scientists such as John Dalton, Michael Faraday, George Johnstone Stoney, Ernest Rutherford, James Chadwick, Antoine Henri Becquerel, Albert Einstein, Max Planck, Ludwig Boltzmann, Hans Christian Oersted, William Conrad (he spells it Konrad) Röntgen, Heinrich Rudolf (he spells it Rudolph) Hertz, Niels Bohr, Erwin Schrödinger, and Pierre Simon Laplace.

In Chapter 4, "Our Place in the Universe" (38 pp), Laidler deals with astronomy, geology, and biology, which he describes as softer than physics and chemistry. He reviews the history of astronomy from its beginnings in Ptolemy, through Nicolaus Copernicus, Johannes Kepler, Galileo Galilei, and William Herschel, to Edwin Powell Hubble, Jocelyn Bell, and Antony (which he spells Anthony) Hewish, and he discusses stars, nebulae, stellar distances, radio waves, quasars, galaxies, dark matter, and brown dwarfs.

In geology he discusses vulcanism, catastrophism, paleontology, glaciers, continental drift, the earth's crust, and the contributions of Abraham Gottlob Werner, James Hutton, William Buckland, Jean Louis Rodolphe Agassiz, and Alfred Lothar Wegener. In biology he begins with Aristotle and continues through Jean Baptiste Lamarck, Erasmus and Charles Darwin, Alfred Russel Wallace, Gregor Mendel, Thomas Hunt Morgan, and Hermann Joseph Müller, and he discusses the inheritance of acquired characteristics, evolution, cells and the nucleus, genes, and chromosomes. He concludes with the various discoveries involved in elucidating the double helical structure of DNA (deoxyribonucleic acid), the contributions of Erwin Chargaff, Linus Pauling, Rosalind Elsie Franklin, James D. Watson, Maurice H. F. Wilkins, and Francis H. C. Crick, and molecular genetics, genomes, the Human Genome Project, and genetic engineering.

In Chapter 5, "How It All Began" (22 pp), Laidler elucidates the astronomical, geological, and biological evidence that supports the modern scientific conclusions about our past, the age of the Earth and of the universe, the Big Bang theory, the four types of force controlling the behavior of matter (electrical, gravity, strong nuclear, and weak nuclear), cosmic microwave background radiation, nucleosynthesis of the elements, radiocarbon dating, and the origin of life, along with the persons involved in these advances.

The next two chapters deal with human culture, beginning with some of the pitfalls that we encounter in forming opinions. Laidler concedes that we have free will, but he thinks that we are all greatly conditioned by our heredity and environment. He discusses how some of the significant conclusions reached by scientific investigations can be useful in dealing with seemingly unrelated problems. Among the most important of these conclusions are: Since nature and nurture are not additive factors, trying to estimate their relative importance is meaningless; chance is important in everyday events; and when a process is occurring continuously, some of its consequences may influence earlier links in the chain of events (the idea of feedback).

Chapter 6, "Science and Culture" (26 pp), begins with how we reach our opinions on scientific problems, which are especially challenging since it is difficult, even for scientists, to be sufficiently well informed about many of them. The problem is much more difficult for nonscientists such as politicians who do not understand the science involved and who frequently deliberately distort scientific findings to further

their own political agenda. In Table 3 (pp 158–160) Laidler gives 16 examples of egregiously bad predictions made by distinguished scientists and technologists such as "Heavier-than-air flying machines are impossible" (Lord Kelvin, 1885) and "I think that there is a world market for maybe five computers" (Thomas Watson of IBM fame, 1943). Laidler discusses the erosion in the public euphoria about science that has occurred since the 1960s largely because of some of its ill effects, and he cites public campaigns against chemistry ("chemophobia"), artificial fertilizers (as opposed to "organic" ones), genetic engineering, cloning, and nuclear power [7]. He presents examples of how pure scientific research has led to practical consequences.

Because I am currently engaged in a battle with proponents of "Intelligent Design," the stealth version of creationism, carried out in letters to the editor of *The Fresno Bee* [8], I found Chapter 7, "Religious Belief" (17 pp), to be the most interesting in the book. Laidler's ideas about religion are in almost complete agreement with mine, and this chapter has provided me with valuable ammunition for the continuing fight.

Laidler deals with virtually all the aspects of the science vs. religion controversy in the context of its history, cultural background, and his own early upbringing and beliefs as well as his "personal philosophy of life in which supernatural events, divine intervention, and an afterlife play no part" (p 192). He analyzes in detail the famous 1860 confrontation over evolution between biologist Thomas Henry Huxley ("Darwin's bulldog") and the Bishop of Oxford, the Right Reverend Samuel ("Soapy Sam") Wilberforce, and he concludes that Huxley made an intemperate attack on religion and that Wilberforce based his objections on bad science.

Laidler discusses faith and reason, the problem of evil and suffering, which he divides into natural and moral; prayer ("What is the point of praying to God if we know that he will not intervene?" p 190); the decline in religious belief during the 19th century ("Unhappily and astonishingly, however, some fundamentalist churches in the United States report an increase in attendance." p 196); the "inverse correlation between intelligence and education on the one hand, and religious belief on the other" (p 197); and the lack of coherence and compatibility in organized religious belief in contrast to the largely coherent picture presented by nonbelievers. He does not include cosmology as an essential part of religion; instead, he claims, it belongs to the province of science.

Laidler considers the undesirable aspects of religion to be aberrations that he divides into two main classes: (1) fundamentalism, the insistence that certain religious writings must be taken literally, and (2) the assertion that, of all the existing religious sects, one's own religion is the only true one, and everyone should be converted to it. He admits that science and religion inhabit different realms of thought, the former, the physical and biological, and the latter, the spiritual. He sees no necessary conflict between them, but he maintains that religious belief creates more problems than it solves.

At the close of a creative and productive life Laidler firmly but humbly proclaims his credo:

As a scientist I am convinced that the only effective method for investigating the physical and biological aspects of the world around us is by strict observation and experiment....I believe that there is a spiritual aspect to our lives as well as a physical one. I do not, however, believe

that supernatural events have ever occurred, since there is no credible evidence for them. I think it likely that the laws of nature have been obeyed at all times. The establishment of these laws of nature, and of the conditions that made our universe possible, may have been brought about by a divine creator, but he seems to me to have left no evidence of his existence. Although I have studied science both intensively and extensively, I can see no “evidence of design.” I can find no reason to believe that there is life after death, and consider it a waste of time to pray or belong to any religious body. I would describe myself as an agnostic with a strong tendency toward atheism. In other words, I keep an open mind, but consider the concept of a god who watches over us and judges us to be beyond belief, because I can find no evidence for it (p 188).

He concludes this chapter with carefully stated comments on the central problem of our day:

The world would be a better place if we all based our opinions not on the teachings laid down centuries ago by religious bodies but on an unprejudiced assessment of what scientific investigations have revealed. Many religious institutions regard themselves as the sole exponents of absolute truth, and have become sharply critical of one another, sometimes with deadly results. Religion is too easily perverted by fanatics.

Science and other scholarly pursuits, on the other hand, make no claim to having attained absolute truth, merely to approaching the truth. It is true that science has from time to time been perverted, and that its products, like atomic bombs and other weapons, have been used for undesirable purposes. It is hard to believe, however, that terrorism, so often carried out in the name of religion, would ever be carried out in the name of science. Since terrorism seems to have become the main scourge of society, we now have an additional reason for displacing religions, especially authoritative [I think that Laidler means “authoritarian” here.—GBK] ones, in favor of a rational philosophy of life based on the observational and experimental evidence derived from the universe around us (p 199).

Chapter 8, “What Is Truth?” (7 pp, the shortest chapter), emphasizes the fact, well known by scientists but misunderstood by laypersons, that no matter how sincerely we employ logic and reason, some doubt must always remain. Laidler distinguishes various kinds of truth—æsthetic, legal, historical, scientific, and religious, the last of which differs greatly from the others because faith plays a large role and evidence a negligible one in it. As he did in earlier chapters, he discusses two essentially different ways of approaching the truth—the intuitive and empirical. Whereas the intuitive can be of great help in formulating a theory, it is unreliable for testing it.

Laidler emphasizes that “there is no such thing as a scientific method.... Instead, there is a method used by scholars, and also by medical practitioners, lawyers, engineers, policeman, and plumbers” (p 204)—a method that he calls the judicial or academic method. The hallmark of this method is objectivity and reliance only on the evidence, and it is used by judges and jurors in contrast to lawyers, politicians, and advertisers, who deliberately slant the evidence in favor of their clients in an adversarial system.

Laidler makes extensive use of numerous striking analogies to elucidate concepts such as Avogadro’s number, and he includes amusing and entertaining anecdotes to illustrate

abstract points. Since his audience is the layperson rather than the scientist, he provides “A Few Points about Mathematics” (4 pp), which introduces the reader to scientific notation, exponential quantities, logarithms, and the metric system, along with conversion tables of length, speed, mass, and temperature, and is similar to the corresponding section in Laidler’s companion volume, *The Harmonious Universe* [3]. Although he includes mathematical equations in terms of words (for example, “pressure  $\times$  volume = constant,” p 35, or “resistance = voltage/current,” p 37), he does not hesitate to use mathematical symbols when he deems it necessary (for example, probably the most famous equation of all time,  $E = mc^2$ , p 56, or “ $\lambda = h/mv = h/p$ ,” p 89). The book contains 23 figures, most of which are portraits; the diagrams were drawn by Laidler’s son, Jim. Documentation is provided in “Notes” (pp 209–216), “Suggested Reading” (pp 217–220) enables readers to pursue matters in more detail, and a detailed index makes the book user-friendly.

I heartily recommend this modestly priced, elegantly and lucidly written volume to anyone who wishes to learn about some of the most significant scientific discoveries presented in their historical context, how science progresses, how science reaches its tentative conclusions, and how science and religion are related. Laidler’s well-balanced arguments should help to combat the current anti-science and anti-intellectual attitudes now so prevalent in our society, especially in the United States.

## References and Notes

1. For biographical information on and obituaries of Laidler see Kauffman, G. B. *Chem. Educator* **2005**, *10*, 320–323; DOI [10.1333/s00897050940a](https://doi.org/10.1333/s00897050940a).
2. Laidler, K. J. *Energy and the Unexpected*; Oxford University Press: Oxford, 2002.
3. Laidler, K. J. *The Harmonious Universe: The Beauty and Unity of Scientific Understanding*; Prometheus Books: Amherst, NY, 2004. For a review see reference 1.
4. Austen, J. *Sense and Sensibility*; with an introduction and notes by L. Engel; Barnes & Noble Classics; Fine Creative Media: New York, 2004.
5. Blake, W. *Auguries of Innocence: A Poem*; Ziggurat Press: Providence, RI, 1997.
6. During the turbulent '60s, when I was exploring an alternative to science, I taught a course, “Mysticism: Eastern and Western, Ancient and Modern,” under the ægis of the CSUF Experimental College, for five semesters. I have since recovered my admiration of science as the best source for knowledge, and I am in complete agreement with Laidler’s viewpoint concerning these two sources and the relationship between them.
7. Laidler, K. J. Science, Technology, and Society: Their complex relationship, and the need for public understanding. *Chem. Intelligencer* **1997**, *3* (1), 46–50.
8. Kauffman, G. B. ‘Stealth’ Version [Intelligent Design Does Not Belong in Science Classes]. *Fresno Bee*, August 11, 2005, p B8; The prize awaits [Intelligent Design is not science]. *Fresno Bee*, September 13, 2005, p B8; Design flaws [Intelligent Design’s shortcomings]. *Fresno Bee*, October 9, 2005, p E2.

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**Encyclopedia of Analytical Science, Second Edition.** Paul Worsfold, Alan Townshend, and Colin Poole, Editors. Elsevier Academic Press: San Diego, CA; London, England, 2005. <http://www.elsevier.com/reference/analytical>. 10 volumes, cclxxx + 5176 pp. 20.6 × 27.5 cm.; hardcover. \$4,570.00; £2,950.00; €4,425.00; ISBN 0-12-764100-9. In the USA or Canada order from Elsevier Regional Sales Office, Customer Service Department, 11830 Westline Industrial Drive, St. Louis, MO 63146, USA; Phone: (800) 545-2522; FAX: (800) 535-9935; email: [usbkinfo@elsevier.com](mailto:usbkinfo@elsevier.com). In the UK and the rest of the world order from Elsevier Customer Service Department, Linacre House, Jordan Hill, Oxford OX2 8DP, UK; Phone: +44 1865 474110; FAX: +44 1865 474111; email: [eurobkinfo@elsevier.com](mailto:eurobkinfo@elsevier.com).



This second edition of the *Encyclopedia of Analytical Science* is dedicated to Robert Macrae, who originated the idea for the first edition [1] after the success of the *Encyclopedia of Food Science, Food Technology and Nutrition* [2], of which he was a leading editor, and who played a large role in its realization as scientific managing editor until his sudden death in 1993.

Editor Paul J. Worsfold is Professor of Analytical Chemistry and Associate Head, School of Earth, Ocean & Environmental Sciences, at the University of Plymouth and Director of the university's Plymouth Environmental Research Centre. Before receiving his B.Sc. from the Loughborough University in 1976, he gained industrial experience at SZKO Chemie in the Netherlands and AEG-Telefunken in Germany. He was awarded M.Sc. (1978) and Ph.D. (1980) degrees in analytical chemistry from the University of Toronto and a D.Sc. degree from the University of Loughborough (1998). His research interests currently lie at the intersection of analytical and environmental science.

Alan Townshend, Professor Emeritus of Analytical Chemistry, was formerly G. F. Grant Professor of Analytical Chemistry and Deputy Dean of the Faculty of Science and Director of the Institute for Chemistry in Industry at the University of Hull, where he served twice as Dean of the School of Chemistry. He holds B.Sc., Ph.D., and D.Sc. degrees from the University of Birmingham, where he lectured on analytical chemistry from 1964 to 1980. His current research interests are in the applications of chemiluminescence and of immobilized reagents (particularly enzymes) and in flow injection analyses.

Like his fellow two editors, Colin F. Poole was born and raised in the United Kingdom. He is Professor of Analytical Chemistry at Wayne State University, where he has been since 1980. He received his B.Sc. (1971) and D.Sc. (1997) degrees

from the University of Leeds, his M.S. from the University of Bristol (1972), and his Ph.D. (1975) from the University of Keele. A polychromatographer with broad interests in the separation and detection of small molecules in biological, environmental, and food samples; sample preparation technology; and computer-aided data analysis techniques, he is the editor of the *Journal of Chromatography* and a member of the editorial boards of five other analytical chemistry journals.

All three widely published editors have authored or coauthored articles in the encyclopedia: Worsfold: "Environmental Analysis," 2: 502–508; "Flow Analysis/Overview," 3:24–31; "Spectrophotometry/Overview," 8: 318–321; and "Water Analysis/Freshwater," 9: 262–268; Townshend: "Titrimetry/Overview," 9: 105–113; and Poole: "Solvent Extraction/Multistage Countercurrent Distribution," 2: 577–584; "Gas Chromatography/Column Technology," 4: 18–34; "Gas Chromatography/Instrumentation," 4: 65–74; "Thin-Layer Chromatography/Principles," 9: 66–77.

The *Encyclopedia of Analytical Science* is a truly international venture. Its 35-member Advisory Board of academic, industrial, and governmental scientists hails from the UK (seven); the USA, Germany, and Spain (four each); Australia (three); Belgium, Russia, and Switzerland (two each); and Austria, Brazil, Canada, Denmark, Ireland, the Netherlands, and Venezuela (one each).

The 643 contributors from academic, industrial, and governmental laboratories worked (at least one died before the encyclopedia was published) in 35 countries—the UK (139); USA (99); Spain (71); Australia (39); Germany (33); Switzerland (31); Czech Republic (20); Japan (19); the Netherlands (17); Canada (15); France (14); Belgium, Hungary, and Poland (11 each); Austria (10); India, Russia, and Sweden (nine each); Finland (seven); Romania (six); Brazil and the Slovak Republic (five each); China and Denmark (four each); Bulgaria and Slovenia (three each); Greece, Israel, Norway, and South Africa (two each); and Kenya, Macedonia, and Taiwan (one each).

The Working Party on Analytical Chemistry of the Federation of European Chemical Societies has defined analytical science as "a scientific discipline that develops and applies methods, instruments, and strategies to obtain information on the composition and nature of matter in space and time" [3]. It not only includes considerable chemistry within its domain but also an increasing amount of biochemistry, electronics, physics, computer science, mathematics, chemometrics, management, and economics.

Analytical science impacts almost all aspects of life in the 21st century. For example, reliable high-quality analytical data are necessary prerequisites for monitoring health and disease, enhancing industrial processes' efficiency, improving product quality, reducing emissions, and studying complex biogeochemical interactions in the environment. New analytical methods make possible advances in the discovery of drugs, forensic science, and life sciences, as well as providing tools for monitoring the quality of pharmaceuticals, foodstuffs, and consumer products, monitoring compliance with legislation, and furthering understanding of environmental processes.

Analyses range from simple color tests for the qualitative identification of cations and anions to complicated, expensive computer-controlled instrumentation for the quantitative determination of trace amounts of a single element or organic compound in a complex matrix. Such instrumentation is

increasingly a hybrid of techniques for separating and detecting substances requiring extensive data processing. The scope of analytical science has become so extensive that, according to the editors of the *Encyclopedia of Analytical Science*,

complete coverage, providing information that is comprehensible to an interested scientist, can only be achieved in a multi-volume encyclopedia...Even then, the length of the...articles needs to be limited in order to keep the size of the encyclopedia manageable (p ix).

The encyclopedia, the volumes of which are separately paginated, is printed on heavy, glossy, acid-free paper. It contains about two and a half million words. The 683 signed and meticulously cross-referenced articles, most of which consist of approximately 4000 words, are alphabetically arranged from "Activation Analysis/ Neutron Activation" to "Zone Refining." The "Guide to Use of the Encyclopedia" (pp xiii–xvi) presents specific directions for locating a specific topic according to three features: by use of the Contents List, Cross-References, and the Index.

Like the first edition, the second edition of the *Encyclopedia of Analytical Science* has been designed to provide a comprehensive, detailed source dealing with all aspects of the science and practice of analysis. To reflect the increasing scope and accelerated rate of change that has occurred during the decade that has elapsed since the first edition, the work has been extensively revised in terms of the titles and content of the first edition. Most of the articles are new or have been extensively rewritten. All subjects have been selected on the basis of their relevance to current, cutting-edge analytical science. Among the new articles are those on DNA sequencing, endocrine-disrupting chemicals, field flow fractionation, "lab-on-a-chip" technologies, nitric oxide, prions, and solid-phase microextraction. An article on the history of analytical chemistry is also included (4: 267). To make space for additional subjects, those that are now considered less appropriate have been deleted from the first edition.

The articles are divided into three main classes: analysis for particular analytes, analysis of particular types of samples, and analytical techniques:

(1) **Analytes** that are subjects of articles include a broad range of organic compounds, such as amino acids, dioxins, fomic and fulvic compounds, lipids, nucleic acids, polycyclic aromatic compounds, and proteins; as well as specific compounds, such as ethanol and glucose; and also compounds with particular types of functions, such as antioxidants, neurotoxins, pesticides, and vitamins. Elements are not dealt with in separate articles except for those that involve significant analytical problems, such as arsenic, carbon, chromium, selenium, and sulfur.

(2) The **types of sample** to be analyzed include effluents, intermediates, products, and raw materials of industrial processes. Because analysis is necessary for controlling the manufacturing process, product quality, and hazards of discharges into the environment, articles are included on diverse products, such as adhesives, building materials, ceramics, glasses, and paints as well as on process analysis *per se*. Food analysis and pharmaceuticals are featured in separate sections, and clinical samples and forensic specimens are the subjects of numerous articles. Blood, coal, fertilizers, and meat are among the specific materials that are dealt with in specific

articles. Means of obtaining representative samples and the processes to which they may be subjected before analysis are emphasized, as is the quality of the analytical process including accreditation, interlaboratory studies, standards, and traceability.

(3) **Analytical techniques** and the wide range of the applications for which they are employed constitute a large portion of the encyclopedia, such as the instrumentation available for making the analytical measurement, for example, atomic absorption and emission spectrometry, chromatography, electrophoresis, fluorimetry, mass spectrometry, nuclear magnetic resonance spectroscopy, X-ray fluorescence spectrometry, and various surface analysis techniques. Other useful techniques that are featured include amplification reactions, such as the polymerase chain reaction (PCR); immunoassays; and radiochemical methods.

Because of the diversity of topics, there is some overlap between articles. Each is self-contained, but extensive cross-references enable the user to locate further information on particular subjects found elsewhere in the encyclopedia. Even in those articles where at first sight there would seem to be a possibility for duplication, each article will be found to have its own individual perspective. For example, articles on ethanol, alcoholic beverages, determination of alcohol in body fluids, forensic sciences, and food and nutritional analysis each have a different emphasis. The relative importance of some topics in current analytical science is reflected in the large number of articles devoted to them. For example, a number of techniques such as atomic emission spectrometry, chromatographic methods (such as gas, liquid, and thin-layer), electrophoresis, mass spectrometry, microscopy, and nuclear magnetic resonance spectroscopy merit a series of articles, which is also the case with such areas as archæometry, food and nutritional analysis, forensic sciences, pharmaceutical analysis, sensors, and surface analysis.

Each of the encyclopedia's ten volumes contains periodic tables (inside front covers), a preface, introduction, guide to the use of the encyclopedia (four pages), and table of contents for the entire set. Each of the volumes has a separate ISBN number:

- Volume 1. "Activation Analysis/Neutron Activation" to "Chemiluminescence/Electrogenerated" (xxxviii + 534 pp; 67 articles); ISBN 0-12-764101-7.
- Volume 2. "Chemometrics and Statistics: Statistical Techniques" to "Extraction/Solid-Phase Microextraction" (xxxviii + 616 pp, the longest volume; 74 articles); ISBN 0-12-764102-5.
- Volume 3. "Fertilizers" to "Functional Group Analysis" (xxxviii + 530 pp; 63 articles); ISBN 0-12-764103-3.
- Volume 4. "Gas Chromatography/Overview" to "Isotope Ratio Measurements" (xxxviii + 560 pp; 68 articles); ISBN 0-12-764104-1.
- Volume 5. "Genetic Methods: Principles and Instrumentation" to "Mercury" (xxxviii + 557 pp; 65 articles); ISBN 0-12-764105-X.
- Volume 6. "Micellar Electrokinetic Chromatography" to "Ozone" (xxxviii + 471 pp; 55 articles); ISBN 0-12-764106-8.
- Volume 7. "Paints: Water-Based" to "Quality Assurance/Water Applications" (xxxviii + 531 pp; 65 articles); ISBN 0-12-764107-6.

- Volume 8. "Radiochemical Methods/Overview" to "Sweeteners" (xxxviii + 572 pp; 72 articles); ISBN 0-12-764108-4.
- Volume 9. "Textiles: Natural" to "Zone Refining" (xxxviii + 468 pp, the shortest volume except for the index; 56 articles); ISBN 0-12-764109-2.
- Volume 10. "Index" (xxxviii + 337 pp); ISBN 0-12-764110-6. In addition to the introductory material contained in all the volumes, this final volume contains a list of contributors (23 double-column pages); 12 appendices of nomenclature; wavelength scale; definitions and symbols for units; fundamental physical constants; properties of particles, elements, and nuclides; conversion of units; statistical tables; biological buffers; pH scale for aqueous solutions; standard potentials in aqueous solutions; solvents for ultraviolet spectrophotometry; and important peaks in the mass spectra of common solvents (43 pp). It also includes an extremely detailed index (269 triple-column pages) from "Abbé, Ernst" (one of the few minor errors in an encyclopedia that is virtually error-free; the correct spelling is "Abbe") to "Zwitterionic surfactants" that facilitates location of information.

The focus of the articles in this encyclopedia is on analytical methods, not on methods for their separation. For a focus on the latter the user should consult the same publisher's *Encyclopedia of Separation Science* [4]. Its presentation is similar to that of the encyclopedia under review (the two are intended to be complementary), and it is also available online.

Like other Elsevier reference works, the encyclopedia is available online on ScienceDirect and is periodically updated. The electronic version allows the user to locate information in a number of ways. The user can browse a subject area, search for a word or phrase across part or all of the encyclopedia, or investigate subject areas outside of his or her field of expertise. Dynamic reference linking leads the user from cited references within articles to the source abstract, quickly and effectively widening the search. The online version permits basic and advanced searches within volumes, parts of volumes, or across the entire set. Searches can be built, saved, and rerun, and saved searches can be combined. All articles are available as full-text html or pdf files, which can be viewed, downloaded, or printed in their original print format. The licensing fee for ongoing annual access depends on the population size of the academic institution: <10,000, \$600, €630; 10,001-25,000, \$1200, €1260; and >25,000, \$1800, €1900. However, these fees are only guidelines, and the institution should consult with Elsevier account managers. For further information on terms and prices, log onto: [http://www.info.sciencedirect.com/reference\\_works/index.shtml](http://www.info.sciencedirect.com/reference_works/index.shtml).

In the editors' words,

This encyclopedia provides detailed information by acknowledged experts on most aspects of modern analytical science. It is designed to be easy to access and, if further information is required, bibliographies are provided. The grouping of subjects and the cross-referencing should emphasize both the variety and the unity of analytical science; that there is a thread that links what at first sight are very diverse topics, but which in fact demand a common philosophy. This "analytical approach" is what the encyclopedia is all about (p xii).

In my opinion, the editors have eminently succeeded in attaining their goal and have produced an authoritative

sourcebook dealing with the entire broad range of analytical science now available.

I am pleased to recommend strongly the *Encyclopedia of Analytical Science*, the most complete and comprehensive basic reference to the field, in both print and electronic formats, to analytical chemists, biochemists, biologists, biomedical researchers, biotechnologists, earth scientists, environmental scientists, forensic scientists, food scientists and technologists, pharmacologists, physicists, and toxicologists. It should also be invaluable to undergraduate and graduate students, postdoctoral fellows, and researchers looking for quick, clear, and concise ideas on topics that lie outside their areas of expertise. This definitive encyclopedia also belongs in academic, industrial, and governmental libraries.

## References and Notes

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**General, Organic, and Biological Chemistry, an Integrated Approach.** By Kenneth W. Raymond. John Wiley and Sons, Inc.: U.S.A., 2006. Hardbound. 494 pp. \$89.95. ISBN 0-471-44707-2.

Chemistry courses for students planning a career in an allied health field, such as nursing or nutrition, often cover different disciplines of chemistry in one semester. Thus, instructors are often under time constraints to engage students in conceptual topics that on the surface may appear unrelated and of little interest to their students. Instructors of such integrated chemistry courses need access to textbooks that, in addition to clear writing and introduction of problem-solving skills, offer examples of chemistry applied to health fields. Failure to see how concepts could be applied in the future could result in less diligence and effort on the student's part. To be effective, texts must also present different chemical disciplines in a manner that allows students to build on earlier work and reinforce learning.

Raymond designed this book for such a course, specifically a one-semester general, organic, and biochemistry course. While the topics covered in the text are typical for such a text, the presentation is not. Rather than dividing the content into separate sections on general, organic, and biochemistry, Raymond integrates all three disciplines throughout. For instance, organic compounds are introduced in Chapter 4, immediately following coverage of ionic and covalent bonds in Chapter 3. Likewise, general chemistry coverage of acids and

bases immediately precedes coverage of organic acids and bases, namely carboxylic acids and amines. Each time topics are integrated, there is also an extension. For instance, not only are acid–base reactions of carboxylic acids and phenols covered, but also oxidation and decarboxylation. The chapters covering the biochemistry of large biomolecules, including oligosaccharides, proteins, and polynucleotides draw on all previous topics. The most impressive chapter of the book is the concluding chapter on metabolism, which unites a wide-range of topics, from thermodynamics to lipids and of course, enzyme catalysis.

The book is written at a level that assumes no prior knowledge of chemistry and reviews the basics, including the scientific method, measurement, scientific notation, and unit conversion within the first chapter. Objectives are stated at the beginning of each chapter and reviewed at the conclusion. The text includes solved sample problems throughout each chapter, each of which is followed by a practice problem for the student to gauge their own mastery of the material. The text also identifies a select few of the end-of-chapter problems and provides students with extra help in the form of online stepwise tutorials or films that relate the selected problem to current events. While such features are laudable, there are not enough problems of this sort that benefit from film or tutorial

support to have an impact on student learning. For students that need extra support, a complimentary study guide and solutions manual is available from the publisher.

Much more exciting is Raymond's use of health links and bBiochemistry links throughout the text. The links provide direct ties between the chemical concepts being presented in the text and topical allied health applications. The chapter on gas laws includes a link on hyperbaric medicine. Biological activity of capsaicin is linked to the chapter that covers phenols. Heat generation by brown fat cells is called out through a health link in the metabolism chapter. Students and instructors will both wish there were more of these links throughout the text. This desire reflects not an oversight on the author's part, but how interesting and applicable the links are.

The author's clear writing, ability to integrate topics in general, organic, and biochemistry, and links to applications in health fields will make this text a popular choice with both instructors and students.

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