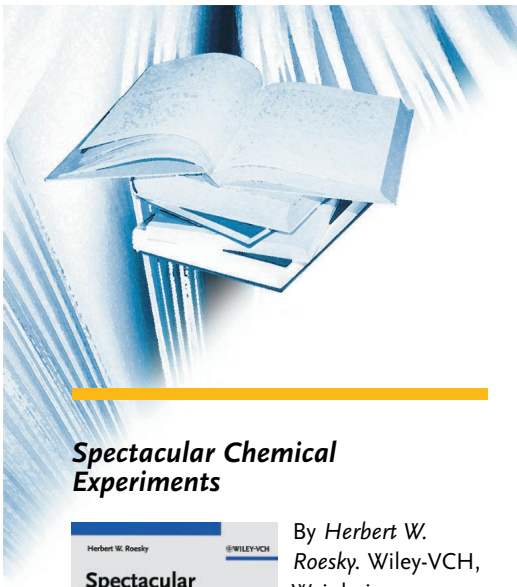
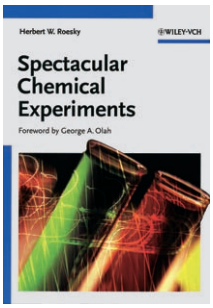


Spectacular Chemical Experiments



By *Herbert W. Roesky*. Wiley-VCH, Weinheim 2007. 226 pp., hardcover € 29.90.—ISBN 978-3-527-31865-0

Chemists world wide are well aware of the excellent scientific contributions from Herbert Roesky and his group at the University of Göttingen. Especially in Europe, chemists are also well aware of his fine contributions in terms of chemical experiments that can be used as demonstrations in undergraduate teaching and traditional Xmas and carnival lectures. He has published a series of books in German on this topic. The latest contribution entitled *Glanzlichter chemischer Experimentierkunst* was published in 2006 and received very good write-ups from my and other groups.[1,2] We use many of his described experiments in our regular "Zaubervorlesung" at the University of Erlangen-Nürnberg in which we follow the concept of Chemistry Edutainment (www.magic-chemistry-lecture.com).

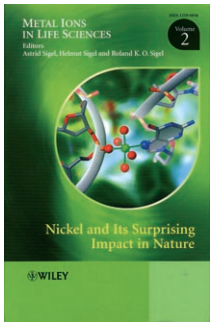
Spectacular Chemical Experiments is a direct translation into English of the original German version referred to above. It describes 86 fascinating experiments illustrated with colored pictures and a detailed description of the experimental procedure. Our comments on the German version[1] equally well apply for the translated version and some of these are repeated here in short. As expected the book contains a series of beautiful and impressive experiments that are well described and explained. These are accompanied by suitable "spiritual" citations to form a philosophical background for the experiments. It wonderfully describes the strong relation between natural sciences and art. This sometimes seems totally forgotten in both disciplines. The original ideas and enthusiasm with which Roesky presents his subject chemistry presents an unusual entertaining and playful view of this natural science. The presented experiments cover a wide range of chemical systems and reactions, and are subdivided into subsections dealing with: water; the color blue; the color red; colloids, sols and gels; fascinating experiments by self-organization; chemical varieties; and the art gallery of chemistry. The range of topics is so broad that it will satisfy the interest of most readers. The produced concept for chemistry can also be applied to other experimental natural sciences. We strongly believe in the educational value of demonstration experiments when they are well integrated into the lecture.

Herbert Roesky has done us and the international chemistry community a big favor by translating his latest contribution in this area into English. It can now be used world wide, but not without a word of warning! The long and presently still practiced tradition at German Universities to include live demonstration experiments in the first semester general chemistry lecture course has led to a wealth of experience in the handling of safety and environmental aspects of the described experiments. In countries where this tradition because of increased safety regulations and money saving developments does not exist anymore, those interested in performing the described experiments must confront themselves with the appropriate safety and environmental regulations not covered in such detail in the book. The easiest way out would be to give up totally on performing demonstration experiments as already done in many countries, but that is definitely not the optimum situation for first year students where the fact that chemistry is an experimental science must come out more clearly in order to present chemistry in its full context! How will anyone learn to handle hazardous chemicals if there is just some kind of second class experience from watching video clips of experiments? For a better understanding, one needs to be in touch with real chemistry, which means to see the experiment, to smell it and to hear it performed live by experienced chemists. In this sense it is important to note that some of the described experiments really need the hand of a professional chemist and special precautions must be taken into account. Safety of the audience as well as the performers must to be the first requirement for chemical demonstration lectures.

Rudi van Eldik
Inorganic Chemistry
University of Erlangen-Nürnberg

[1] R. van Eldik, *Nachr. Chem.* **2006**, *54*, 698.
[2] M. Veith, *Angew. Chem.* **2007**, *119*, 1025.

Nickel and Its Surprising Impact in Nature



Metal Ions in Life Sciences, Vol. 2. Edited by *Astrid Sigel*, *Helmut Sigel*, and *Roland K. O. Sigel*. John Wiley & Sons, Hoboken 2007. 728 pp., hardcover € 309.00.—ISBN 978-0-470-01671-8

This new contribution in the *Metal Ions in Life Sciences* series, *Nickel and its Surprising Impact in Nature*, is a comprehensive and authoritative reference source covering the current understanding of nickel in bio-geochemistry, biology, chemistry, and biochemistry. The book includes 17 chapters, authored by 47 experts in their particular areas. The book is well organized, except for a few chapters that could have been made more succinct by omitting information

that is covered in detail in other chapters and simply citing those chapters.

After beginning appropriately in Chapter 1 with the bio-geochemistry of nickel and the interesting history of nickel and its uses and bioavailability, this "encyclopedia of nickel" then covers, in Chapter 2, the biological requirements and toxicity of nickel, and various ways that organisms scavenge, exclude, or sequester nickel. The first two chapters, including nearly 400 references, provide a launching ground for the more specific topics that follow. A discussion of the methods and pitfalls related to the task of determining nickel concentrations will be useful for all scientists studying nickel chemistry and biochemistry. Discussions of the complex issues of nickel mobility and bioavailability are highlights of Chapter 2. Chapters 3 and 4 cover the inorganic chemistry of nickel comprehensively, including complexes of Ni with amino acids, peptides, sugars, and nucleotides, and citing almost 500 references. The treatment of multicomponent systems impresses the reader with the complexity of speciation that is already observed in a controlled solution, and will be magnified many-fold in a living cell that must traffic different metal ions to their correct destination in a protein, and provides principles that will help guide the understanding of metal complexation in biology. Chapter 5 links together the inorganic and the biological chemistry of nickel, with a detailed description of synthetic models of the active sites of the nickel-containing proteins that are covered in the subsequent chapters. The biomimetic chemistry described in this chapter complements the excellent 1994 review by Halcrow and Christou on nickel model complexes (M. A. Halcrow, G. Christou, *Chem. Rev.* **1994**, 2421–2476). This update covers much important research that followed the determination of the crystal structures of the nickel metalloenzymes, many of which were found to contain unexpected and novel coordination environments. This coordination chemist's view of the active site structures, and of the challenges that remain to be overcome to synthesize structural and functional models of these sites, impresses the reader with the elegance of nature's bioinorganic solutions to performing some extremely difficult chemical reactions.

This nickel encyclopedia continues with seven chapters that deal with nickel-based enzymology. The first of these, Chapter 6, is a structure-based discussion of urease that includes the various forms of urease (with different metals, substrates, and inhibitors) that have been crystallized. A must-read for nickel biochemists is the authoritative review in Chapter 7 on Ni-Fe hydrogenases, which integrates genetic, X-ray crystallographic, and spectroscopic results from many laboratories over the past decade, and includes controversial topics and unresolved issues. Chapter 8, on methyl-coenzyme M reductase and coenzyme F_{430}, contains a thorough description of the recent work of the authors, who have made the major contributions to the study of this enzyme over the last decade; it should serve as a suitable introduction for the metalloenzyme community and for anyone planning to enter this field. The comprehensive review on acetyl-CoA synthases (ACS) and Ni-containing CO dehydrogenases (CODH) in Chapter 9 describes some controversial topics, along with the authors' suggestion of how divergent views can be resolved; however, readers might prefer a more balanced view of some of the controversial issues. The chapter on superoxide dismutase is comprehensive, succinct, and authoritative. It covers some topics of general interest to the metalloenzyme community, including the unusual nickel coordination environment (the nickel hook) and its role in tuning the redox potential, the importance of proteolytic processing to generate the active protein, and potential pathways for proton transfer that are different from that used by the non-nickel superoxide dismutases. The next two chapters describe enzymes (glyoxylase I and acireductone dioxygenase) in which several other metal ions can substitute for nickel. Glyoxylase I, covered in Chapter 11, is described as an enzyme that can incorporate several different metals, although Ni seems to be the most active in some forms of the glyoxylase. Whereas in glyoxylase I the versions with different metals catalyze formation of the same products, for acireductone dioxygenase (covered in

Chapter 12), which is a member of the cupin super-family, the product distribution depends upon whether Ni or Fe is at the active site. The acireductone dioxygenase is of special biomedical interest, since it is not yet known whether the human enzyme contains Ni or Fe (or perhaps another metal). Furthermore, it seems possible that the first known Ni-containing enzyme in humans may complement the function of heme oxygenase as a source of CO, which has been recognized as an important signaling molecule.

The last five chapters of the book include important information about the assembly of nickel into metallocenters, Ni-dependent gene expression, and the role of nickel in pathogenesis and toxicity. Chapter 13, on SlyD, covers the literature on this protein up to 2005; however, the link to nickel metabolism does not become clear until late in the review. The chapter omits two very significant recent findings by Zamble, namely that SlyD is a molecular chaperone for hydrogenase, and that the *cis–trans* prolyl isomerase activity of SlyD is not involved in its function in the maturation of hydrogenase. Chapter 14, although it suffers from the slight distraction of including eight pages reviewing the nickel enzymes that are already covered in detail in Chapters 7–12, provides important and up-to-date information on metallochaperones (UreE, the HypAB, SlyD, CooJ) that incorporate Ni, and on molecular chaperones (UreDFG, HypBC, CooC, and AcsF) that facilitate formation of the Ni metallocenters of urease, hydrogenase, and CO dehydrogenase. Whereas Chapter 6 covered the structural details of urease, Chapter 15 focuses more on the pathogen *Helicobacter pylori* and the involvement of urease and nickel in the biology and pathogenesis of this organism. This chapter provides an excellent description of the important aspects of metal ion homeostasis, regulation, and catalytic activity in the biology of an organism. Chapter 15 also covers the interesting topic of nickel-dependent gene expression by NikR, which one would probably have expected to see in Chapter 16 on nickel-dependent gene expression. Instead, Chapter 15 focuses on the association of nickel with changes in gene expression patterns in mammals, with an emphasis on pathological aspects of nickel. Chapter 17 describes the toxicology and pathology associated with elevated (or reduced) levels of nickel in the environment, and cites over 250 references. Interesting concepts developed in this chapter include the relationship between the toxicity of nickel and its redox activity with various cellular ligands, and the apparent effect of nickel exposure on the selection of cells with a high glycolytic rate (e.g., cancer cells).

The book is recommended for researchers studying any subject relating to the role of metals in biology, especially those with a special interest in nickel.

Stephen W. Ragsdale
Department of Biological Chemistry
University of Michigan Medical School
Ann Arbor (USA)

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