

# STRUCTURE AND BONDING 64

W. R. Scheidt Y. J. Lee  
Recent Advances in the Stereochemistry  
of Metallotetrapyrroles

T. Kitagawa Y. Ozaki  
Infrared and Raman Spectra of Metalloporphyrins

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Synthesis and Structure of Biomimetic Porphyrins

R. Guillard C. Lecomte K. M. Kadish  
Synthesis, Electrochemistry, and Structural Properties  
of Porphyrins with Metal-Carbon Single Bonds and  
Metal-Metal Bonds

## Metal Complexes with Tetrapyrrole Ligands I



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# 64 Structure and Bonding

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Editor: J. W. Buchler

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With 73 Figures and 58 Tables



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# Foreword

Metal complexes of tetrapyrrole ligands are a large class of coordination compounds that are at least as important and versatile as other classes of coordination compounds, e.g. the metal carbonyls, despite the apparent rigidity of the tetradentate macrocycle. This class comprises not only the biologically important heme-, chlorophyll-, and vitamin B<sub>12</sub> derivatives, but also the phthalocyanines, which have found wide application as pigments and are presently being studied as organic materials for a variety of electronic devices. The state of knowledge in this field is well documented up to the end of the seventies in several notable editions: the single volume "*Porphyrins and Metalloporphyrins*", K. M. Smith (Ed.), Elsevier, Amsterdam, 1975, the seven volumes "*The Porphyrins*", D. Dolphin (Ed.), Academic Press, New York, 1978/79, the two volumes "*Vitamin B<sub>12</sub>*", D. Dolphin (Ed.), Wiley, New York 1982, and the volume "*Coordination Compounds of Porphyrins and Phthalocyanines*", B. D. Berezin, Wiley, Chichester 1981. The abundance of research on heme derivatives justified two further volumes "*Iron Porphyrins*", H. B. Gray, A. B. Lever (Eds.), Addison-Wesley, Reading/Mass., 1983.

Progress in this field, however, is so rapid that Professor *James A. Ibers*, member of the editorial board of this series, felt it necessary to publish a special volume on metalloporphyrins and suggested me as a guest editor. Living very close to Springer-Verlag, I agreed to start the venture; good cooperation with Dr. Rainer Stumpe and his team in Heidelberg was greatly facilitated. Fortunately, more authors were willing to contribute than could be included in this volume, therefore, there will be a second one. Many thanks are due to the authors who have postponed a good deal of urgent research, presented their current expertise and who gave the impression to the reading guest editor that he was participating in the opening night of an exciting play.

The first two articles are very relevant to the title of the series. The reviews on *Stereochemistry* (W. Robert Scheidt and Young Ja Lee) and *Vibrational Spectra* (Teizo Kitagawa) demonstrate how subtle the interactions between the metal and the tetrapyrrole ligand are, and that an enormous amount of data is available which provide a deep insight into the intra- and intermolecular bonding of metal tetrapyrrole systems which will stimulate further studies of structure-function relationships in the biochemistry of tetrapyrrole systems.

The second two articles represent novel developments in the synthetic chemistry of tetrapyrrole complexes. Following the first papers of *T. G.*

*Traylor, J. P. Collman, and J. E. Baldwin* describing porphyrins with peripheral modifications meant to implant properties to a heme molecule that otherwise are only found in the macromolecular heme proteins, ingenious organic chemists have created a large variety of substituted porphyrins that can no longer be kept in mind by coordination chemists. Therefore, the article on *Biomimetic Porphyrins* (Brian Morgan and David Dolphin) is a very timely and useful aid for everybody working or interested in the field. The article on *Metal Carbon Sigma Bonds and Metal Metal Bonds* (Roger Guilard, Karl Kadish, and Claude Lecomte) documents how building blocks known from organometallic chemistry may be combined with metalloporphyrin systems producing some very fascinating novel classes of molecules.

Contributions covering the properties of metal tetrapyrroles as organic electrical materials, the noble metal porphyrins, photophysical aspects, progress in the chemistry of cytochrome P-450 models, and extended x-ray absorption fine structure are planned for the second volume.

Darmstadt, April 1, 1987

Johann W. Buchler

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