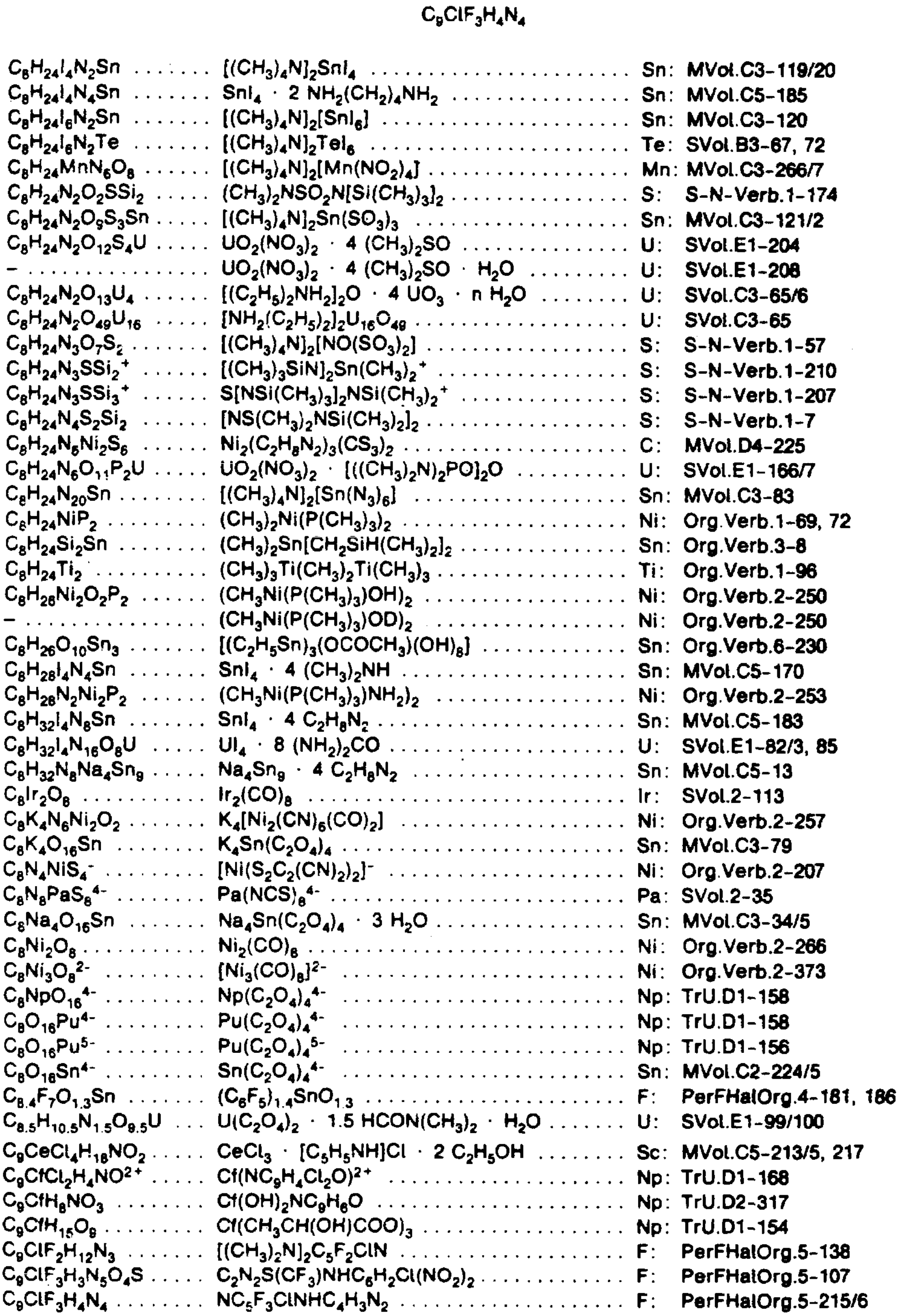
Gmelin handbook of inorganic chemistry, 8th edition, *INDEX, Formula Index, 1st Supplement*, Springer-Verlag, Berlin, Heidelberg, New York, Tokyo.
Volume 3, B_2–B_{100}, ix + 262 pages, DM 980, 1984. ISBN 3-540-93483-9.
Volume 4, Ba–C_7, ix + 269 pages, DM 1040, 1985. ISBN 3-540-93484-7.
Volume 5, C_8–C_{17}, ix + 227 pages, DM 848, 1985. ISBN 3-540-93485-5.
Volume 6, C_{18}–C_{x},, ix + 233 pages, DM 877, 1986. ISBN 3-540-93486-3.
Volume 7, Ca–I, xi + 247 pages, DM 997, 1986. ISBN 3-540-93487-1.
Volume 8, In–Zr, xi + 211 pages, DM 895, 1986. ISBN 3-540-93488-X.

The Main Formula Index, published in twelve volumes between 1975 and 1980, covered all the volumes of the Main Series of the eighth edition of the Gmelin Handbook up to the end of 1974, as well as the New Supplement Series up to the end of 1973. The First Supplement to the Formula Index (the subject of this review) continues this Index up to the end of 1979, and a Second Supplement is currently under preparation, which will cover 1980–1985. This First Supplement consists of eight volumes in total (the first two have been reviewed in earlier volumes of *J. Organomet. Chem.*, 282 (1985) C23; 276 (1984) C38), and the basic structure of the Main Formula Index has been retained. Thus, the Index lists all the elements, compounds, ions, and systems having definite composition that have been described in the text of the Handbook. The index is in three-column format: the first column gives the empirical formula, the second gives the conventional formula as it appears in the Handbook text (as well as any additional information or subdivisions), and the third gives the volume and page reference. A typical page is replicated in Fig. 1.

The empirical formula index is arranged in alphabetic and alphanumeric order—C and H are *not* placed first. Ions are always placed after neutral species and anions precede cations. The transuranium elements which do not, as yet, have a universally agreed name (104–120) are listed at the end of Volume 8 under their atomic number (and not, as may have been expected, as Unq, Unp, Unh, Uns, etc.). Polymers of the type $\{AB\}_n$ are listed under AB, and multi-component systems (e.g. mixed crystals and melts) are listed under the empirical formulae of their components.

Entries with the same empirical formulae are distinguished in the second column, and arranged in the order compounds, isotopic species, polymers, hydrates, and multicomponent systems. Entries for elements and compounds with multiple occurrences are subdivided by topics, and an example is shown in Fig. 2.

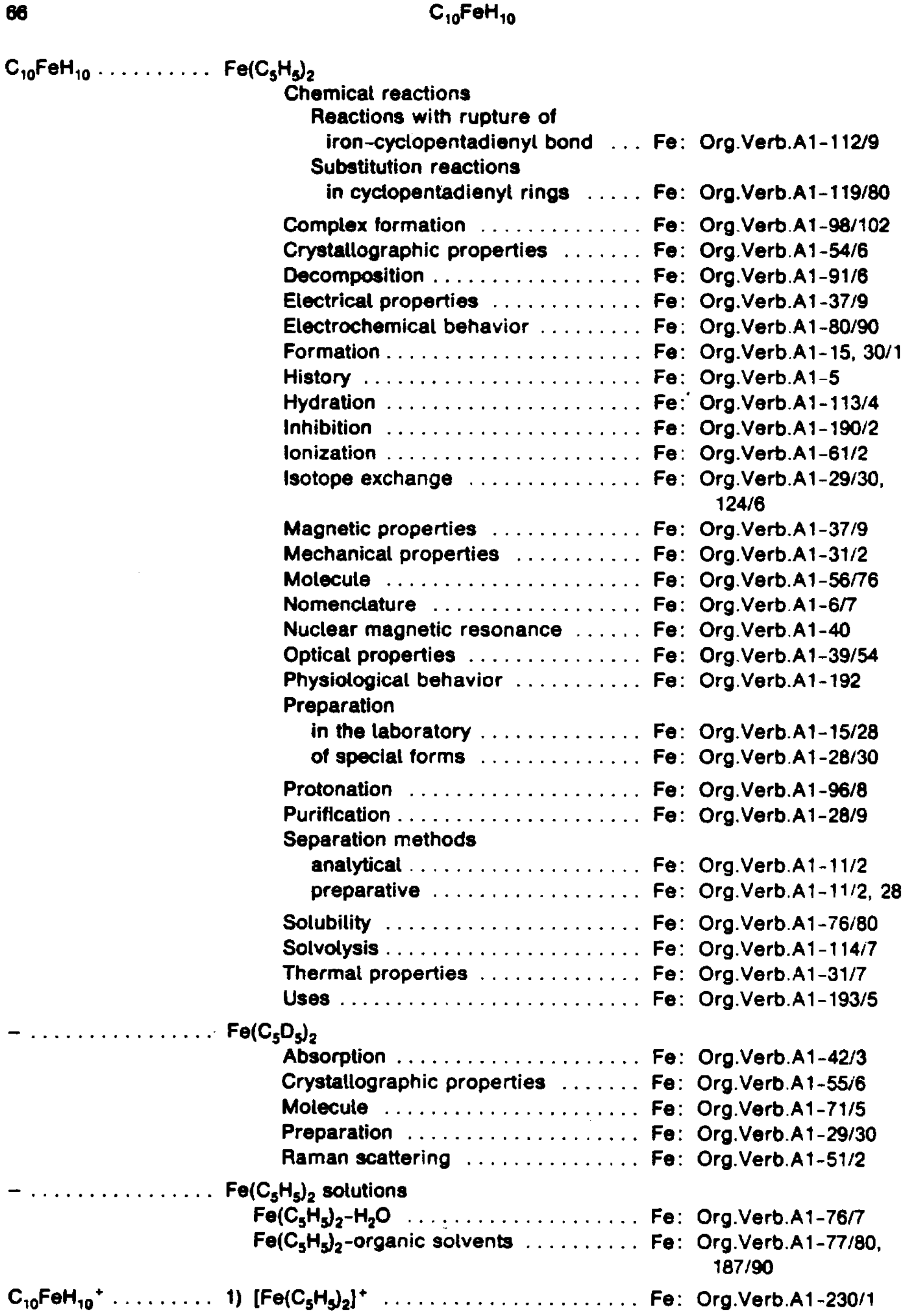
The Oxford English Dictionary defines an index as "an alphabetical list, placed (usually) at the end of a book, of the names, subjects, etc. occurring in it, with indication of the places in which they occur". The formula index is thus aptly named and fulfils its purpose perfectly. It is equivalent to the Collective Index of *Chemical Abstracts*—you can use the work without it, but your life is a lot easier if you possess it. A work of the size of the Gmelin Handbook relies upon the ease of access to its information for its success. It is no good having a totally comprehensive source of data if the information that you are seeking cannot be found, and this Formula Index makes that access easier. The use of empirical formulae as a means of indexing a chemical treatise is well established, and is particularly appropriate to the arrangement of information within the Handbook. The arrangement, clarity and presentation of these volumes is first class, and I do not believe that any library which possesses the Gmelin Handbook volumes published between 1974 and 1979 will wish to be without the eight volumes of the Index. It is a welcome addition to the series, adding to its value and utility.



$C_9ClF_3H_4N_4$ 31

$C_8H_{24}I_4N_2Sn$	$[(CH_3)_4N]_2SnI_4$	Sn:	MVol.C3-119/20
$C_8H_{24}I_4N_4Sn$	$SnI_4 \cdot 2\ NH_2(CH_2)_4NH_2$	Sn:	MVol.C5-185
$C_8H_{24}I_6N_2Sn$	$[(CH_3)_4N]_2[SnI_6]$	Sn:	MVol.C3-120
$C_8H_{24}I_6N_2Te$	$[(CH_3)_4N]_2TeI_6$	Te:	SVol.B3-67, 72
$C_8H_{24}MnN_6O_8$	$[(CH_3)_4N]_2[Mn(NO_2)_4]$	Mn:	MVol.C3-266/7
$C_8H_{24}N_2O_2SSi_2$	$(CH_3)_2NSO_2N[Si(CH_3)_3]_2$	S:	S-N-Verb.1-174
$C_8H_{24}N_2O_9S_3Sn$	$[(CH_3)_4N]_2Sn(SO_3)_3$	Sn:	MVol.C3-121/2
$C_8H_{24}N_2O_{12}S_4U$	$UO_2(NO_3)_2 \cdot 4\ (CH_3)_2SO$	U:	SVol.E1-204
–	$UO_2(NO_3)_2 \cdot 4\ (CH_3)_2SO \cdot H_2O$	U:	SVol.E1-208
$C_8H_{24}N_2O_{13}U_4$	$[(C_2H_5)_2NH_2]_2O \cdot 4\ UO_3 \cdot n\ H_2O$	U:	SVol.C3-65/6
$C_8H_{24}N_2O_{49}U_{16}$	$[NH_2(C_2H_5)_2]_2U_{16}O_{49}$	U:	SVol.C3-65
$C_8H_{24}N_3O_7S_2$	$[(CH_3)_4N]_2[NO(SO_3)_2]$	S:	S-N-Verb.1-57
$C_8H_{24}N_3SSi_2^+$	$[(CH_3)_3SiN]_2Sn(CH_3)_2^+$	S:	S-N-Verb.1-210
$C_8H_{24}N_3SSi_3^+$	$S[NSi(CH_3)_3]_2NSi(CH_3)_2^+$	S:	S-N-Verb.1-207
$C_8H_{24}N_4S_2Si_2$	$[NS(CH_3)_2NSi(CH_3)_2]_2$	S:	S-N-Verb.1-7
$C_8H_{24}N_6Ni_2S_6$	$Ni_2(C_2H_8N_2)_3(CS_3)_2$	C:	MVol.D4-225
$C_8H_{24}N_6O_{11}P_2U$	$UO_2(NO_3)_2 \cdot [((CH_3)_2N)_2PO]_2O$	U:	SVol.E1-166/7
$C_8H_{24}N_{20}Sn$	$[(CH_3)_4N]_2[Sn(N_3)_6]$	Sn:	MVol.C3-83
$C_8H_{24}NiP_2$	$(CH_3)_2Ni(P(CH_3)_3)_2$	Ni:	Org.Verb.1-69, 72
$C_8H_{24}Si_2Sn$	$(CH_3)_2Sn[CH_2SiH(CH_3)_2]_2$	Sn:	Org.Verb.3-8
$C_8H_{24}Ti_2$	$(CH_3)_3Ti(CH_3)_2Ti(CH_3)_3$	Ti:	Org.Verb.1-96
$C_8H_{26}Ni_2O_2P_2$	$(CH_3Ni(P(CH_3)_3)OH)_2$	Ni:	Org.Verb.2-250
–	$(CH_3Ni(P(CH_3)_3)OD)_2$	Ni:	Org.Verb.2-250
$C_8H_{26}O_{10}Sn_3$	$[(C_2H_5Sn)_3(OCOCH_3)(OH)_8]$	Sn:	Org.Verb.6-230
$C_8H_{28}I_4N_4Sn$	$SnI_4 \cdot 4\ (CH_3)_2NH$	Sn:	MVol.C5-170
$C_8H_{28}N_2Ni_2P_2$	$(CH_3Ni(P(CH_3)_3)NH_2)_2$	Ni:	Org.Verb.2-253
$C_8H_{32}I_4N_8Sn$	$SnI_4 \cdot 4\ C_2H_8N_2$	Sn:	MVol.C5-183
$C_8H_{32}I_4N_{16}O_8U$	$UI_4 \cdot 8\ (NH_2)_2CO$	U:	SVol.E1-82/3, 85
$C_8H_{32}N_8Na_4Sn_9$	$Na_4Sn_9 \cdot 4\ C_2H_8N_2$	Sn:	MVol.C5-13
$C_8Ir_2O_8$	$Ir_2(CO)_8$	Ir:	SVol.2-113
$C_8K_4N_6Ni_2O_2$	$K_4[Ni_2(CN)_6(CO)_2]$	Ni:	Org.Verb.2-257
$C_8K_4O_{16}Sn$	$K_4Sn(C_2O_4)_4$	Sn:	MVol.C3-79
$C_8N_4NiS_4^-$	$[Ni(S_2C_2(CN)_2)_2]^-$	Ni:	Org.Verb.2-207
$C_8N_8PaS_8^{4-}$	$Pa(NCS)_8^{4-}$	Pa:	SVol.2-35
$C_8Na_4O_{16}Sn$	$Na_4Sn(C_2O_4)_4 \cdot 3\ H_2O$	Sn:	MVol.C3-34/5
$C_8Ni_2O_8$	$Ni_2(CO)_8$	Ni:	Org.Verb.2-266
$C_8Ni_3O_8^{2-}$	$[Ni_3(CO)_8]^{2-}$	Ni:	Org.Verb.2-373
$C_8NpO_{16}^{4-}$	$Np(C_2O_4)_4^{4-}$	Np:	TrU.D1-158
$C_8O_{16}Pu^{4-}$	$Pu(C_2O_4)_4^{4-}$	Np:	TrU.D1-158
$C_8O_{16}Pu^{5-}$	$Pu(C_2O_4)_4^{5-}$	Np:	TrU.D1-156
$C_8O_{16}Sn^{4-}$	$Sn(C_2O_4)_4^{4-}$	Sn:	MVol.C2-224/5
$C_{8.4}F_7O_{1.3}Sn$	$(C_6F_5)_{1.4}SnO_{1.3}$	F:	PerFHalOrg.4-181, 186
$C_{8.5}H_{10.5}N_{1.5}O_{9.5}U$	$U(C_2O_4)_2 \cdot 1.5\ HCON(CH_3)_2 \cdot H_2O$	U:	SVol.E1-99/100
$C_9CeCl_4H_{18}NO_2$	$CeCl_3 \cdot [C_5H_5NH]Cl \cdot 2\ C_2H_5OH$	Sc:	MVol.C5-213/5, 217
$C_9CfCl_2H_4NO^{2+}$	$Cf(NC_9H_4Cl_2O)^{2+}$	Np:	TrU.D1-168
$C_9CfH_8NO_3$	$Cf(OH)_2NC_9H_6O$	Np:	TrU.D2-317
$C_9CfH_{15}O_9$	$Cf(CH_3CH(OH)COO)_3$	Np:	TrU.D1-154
$C_9ClF_2H_{12}N_3$	$[(CH_3)_2N]_2C_5F_2ClN$	F:	PerFHalOrg.5-138
$C_9ClF_3H_3N_5O_4S$	$C_2N_2S(CF_3)NHC_6H_2Cl(NO_2)_2$	F:	PerFHalOrg.5-107
$C_9ClF_3H_4N_4$	$NC_5F_3ClNHC_4H_3N_2$	F:	PerFHalOrg.5-215/6

Fig. 1. An extract of the Formula Index, taken from Volume 5.



66 $C_{10}FeH_{10}$

$C_{10}FeH_{10}$ .... $Fe(C_5H_5)_2$
- Chemical reactions
  - Reactions with rupture of iron-cyclopentadienyl bond ... Fe: Org.Verb.A1-112/9
  - Substitution reactions in cyclopentadienyl rings ..... Fe: Org.Verb.A1-119/80
- Complex formation .... Fe: Org.Verb.A1-98/102
- Crystallographic properties .... Fe: Org.Verb.A1-54/6
- Decomposition .... Fe: Org.Verb.A1-91/6
- Electrical properties .... Fe: Org.Verb.A1-37/9
- Electrochemical behavior .... Fe: Org.Verb.A1-80/90
- Formation .... Fe: Org.Verb.A1-15, 30/1
- History .... Fe: Org.Verb.A1-5
- Hydration .... Fe: Org.Verb.A1-113/4
- Inhibition .... Fe: Org.Verb.A1-190/2
- Ionization .... Fe: Org.Verb.A1-61/2
- Isotope exchange .... Fe: Org.Verb.A1-29/30, 124/6
- Magnetic properties .... Fe: Org.Verb.A1-37/9
- Mechanical properties .... Fe: Org.Verb.A1-31/2
- Molecule .... Fe: Org.Verb.A1-56/76
- Nomenclature .... Fe: Org.Verb.A1-6/7
- Nuclear magnetic resonance ...... Fe: Org.Verb.A1-40
- Optical properties .... Fe: Org.Verb.A1-39/54
- Physiological behavior .... Fe: Org.Verb.A1-192
- Preparation
  - in the laboratory .... Fe: Org.Verb.A1-15/28
  - of special forms .... Fe: Org.Verb.A1-28/30
- Protonation .... Fe: Org.Verb.A1-96/8
- Purification .... Fe: Org.Verb.A1-28/9
- Separation methods
  - analytical .... Fe: Org.Verb.A1-11/2
  - preparative .... Fe: Org.Verb.A1-11/2, 28
- Solubility .... Fe: Org.Verb.A1-76/80
- Solvolysis .... Fe: Org.Verb.A1-114/7
- Thermal properties .... Fe: Org.Verb.A1-31/7
- Uses .... Fe: Org.Verb.A1-193/5

– .... $Fe(C_5D_5)_2$
- Absorption .... Fe: Org.Verb.A1-42/3
- Crystallographic properties .... Fe: Org.Verb.A1-55/6
- Molecule .... Fe: Org.Verb.A1-71/5
- Preparation .... Fe: Org.Verb.A1-29/30
- Raman scattering .... Fe: Org.Verb.A1-51/2

– .... $Fe(C_5H_5)_2$ solutions
- $Fe(C_5H_5)_2$-H_2O .... Fe: Org.Verb.A1-76/7
- $Fe(C_5H_5)_2$-organic solvents .... Fe: Org.Verb.A1-77/80, 187/90

$C_{10}FeH_{10}^+$ .... 1) $[Fe(C_5H_5)_2]^+$ .... Fe: Org.Verb.A1-230/1

Fig. 2. An example of subdivision by topic, taken from Volume 5.

One final point is, perhaps, worth making. In the foreword to these volumes, the editor (Rudolf Warnke) stresses that the First Supplement of the Formula Index was compiled and printed "with extensive use of computers". It would be worth the Gmelin Institute and Springer-Verlag considering that, in 1987, most chemists possess an IBM (or IBM compatible) microcomputer (or have easy access to one). I would have thought that an index of this size and complexity would be ideally suited to a database format, and could be issued and sold on floppy disc, vastly enhancing its usefulness and enabling chemists with specialized interests to compile their own personalized index to the Handbook. I certainly hope that some consideration will be given to this suggestion—if the index is already computerized, producing such a database should be relatively easy. This would be a rather different exercise to the recently announced Gmelin Formula Index Database (GFI), which appears to be for on-line access only.

School of Chemistry and Molecular Sciences
University of Sussex, Brighton, BN1 9QJ (Great Britain)

Kenneth R. Seddon

Metal Ions in Biological Systems, Volume 22. ENDOR, EPR, and Electron Spin Echo for Probing Coordination Spheres; Edited by Helmut Sigel. 1987. 328 pages, bound, illustrated. $89.75 (U.S. and Canada); $107.50 (All other countries).

This is an interesting book, covering a range of specialised techniques within the broad area of physical studies of metalloenzyme structure and functioning. The techniques discussed generally involve investigations of relatively weak hyperfine interactions of ligands with the central metal atom. There are five chapters, of which two are short and three longer.

Hüttermann and Kappl review the ENDOR technique. Around a thousand-fold better resolution of hyperfine couplings, than that obtainable with EPR, is available when using ENDOR. Coupling from ligand nuclei and neighbouring atoms up to 6 Å from the metal atom are frequently detectable by ENDOR. Sensitivity, however, is lower than that of EPR. Theory, instrumentation and techniques are reviewed, but the chapter is mainly concerned with results, with emphasis on copper and haem systems. ENDOR can now be considered a well-established technique in this area of research and its use is expanding. A limitation, however, is that satisfactory procedures for computer simulation of ENDOR spectra as an aid to their interpretation, have yet to be developed.

A brief chapter by Kalbitzer is highly specialised, describing effects of ^{17}O on the EPR spectra of manganese complexes of nucleotides bound to proteins, in which the isotope is specifically incorporated into the phosphate groups of the nucleotide. Manganese here replaces the magnesium which functions in vivo. Examination of the broadening of the EPR spectra makes it possible to find which of the oxygens coordinate to the metal.

A further brief and specialised chapter by Gampp, discusses use of EPR for studies of solution equilibria, in the case where complexed and free paramagnetic species have different EPR spectra. Computing procedures, where the parent EPR, spectra are not known and where as many as four separate species having overlapping EPR spectra are present are discussed. So far the techniques seem to have been