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SPIN TRAPPING: ESR PARAMETERS OF SPIN ADDUCTS*

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Abstract—Spin trapping has become a valuable tool for the study of free radicals in biology and medicine. The electron spin resonance hyperfine splitting constants of spin adducts of interest in this area are tabulated. The entries also contain a brief comment on the source of the radical trapped.

Key words—ESR (electron spin resonance), Free radicals, Spin trapping, DMPO (5,5-Dimethylpyrroline-1-oxide), PBN (α-phenyl-*N*-*tert*-butyl nitrone), MNP (2-methyl-2-nitrosopropane)

INTRODUCTION

Spin trapping

In biology and medicine free radicals are now of intense interest because they appear to be involved in many different aspects of metabolism, ranging from oxygen consumption to xenobiotic metabolism. ESR (electron spin resonance) is considered the least ambiguous method for the detection of free radicals. Unfortunately, it is not always possible to directly observe the free radicals of interest as their concentration may be below the limit of detection by the present generation of ESR spectrometers ($\sim 10^{-8}$ M, a practical limit is probably $\sim 10^{-6}$ M). In addition, some radicals, even if present at a concentration greater than 10^{-8} M, are not observable at room or physiological temperature as their spin relaxation times are very short, making their linewidth too broad to be observed by ESR. Examples are $O_2^{\cdot-}$, $^{\cdot}OH$, alkoxyl radicals, and sulfur-centered radicals such as the cysteinyl or glutathiyl free radicals. Spin trapping provides, in principle, a means to overcome these problems.

The experiment. Spin trapping involves the addition reaction of the free radical of interest to a diamagnetic compound, spin trap, to produce a relatively long-lived free radical product, spin adduct (usually a nitroxide), which hopefully accumulates to a concentration high enough to be studied by ESR. Nitroxides are relatively stable because the unpaired electron is resonance stabilized. In favorable cases the resulting ESR spectrum allows the identification of the original radical. If no unique assignment is feasible, it is still possible to learn something about the nature of the radical, i.e. whether it is carbon-centered, oxygen-centered, nitrogen-centered, etc. Spin traps do not react readily with resonance-stabilized radicals and thus are of little help in increasing their visibility; however, resonance-stabilized radicals are the easiest to observe directly. Direct ESR observation generally provides the most information about the radical, unfortunately many radicals cannot be observed directly by ESR. Thus, spin trapping has become a valuable tool for the study of free radical processes.

Two kinds of spin traps have been developed, nitrone and nitroso compounds. Nitroso compounds, such as MNP, can provide considerably more information than nitrones as the radical to be trapped adds directly to the nitroso nitrogen,

$$R{-}N{=}O + R_x^{\cdot} \longrightarrow R{-}\underset{\displaystyle R_x}{\overset{\displaystyle |}{\overset{\displaystyle \cdot}{N}}}{-}O,$$

thereby increasing the amount of information in the hyperfine splitting parameters. Unfortunately, oxygen-

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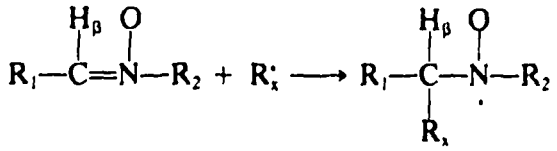
*The abbreviations used in this article appear in the appendix.

centered radical adducts of MNP are quite unstable, thus the nitrones are the spin traps of choice for the study of oxygen-centered radicals.

With nitrones some information is lost because the trapped radical adds to a carbon adjacent to the nitrogen.



However, the most popular spin traps, DMPO, PBN, and POBN have a β-hydrogen that can provide considerable information about the radical trapped.

Hyperfine splitting. The information about the radical trapped is contained in the hyperfine splitting of the spin adducts. The multiplicity and magnitude of the splittings provide this information. Excellent didactic presentations on nitroxide hyperfine splittings have been given by Janzen et al.[1] and Thornalley.[2] Thus, these references should be consulted by those wanting an introduction to the fundamental aspects of spin trapping and the ESR spectroscopy of nitroxides.

Kotake et al.[3] have demonstrated that ENDOR has the potential to provide information that can assist in the interpretation of spin trapping experiments. For example, Evans et al.[4] have used spin trapping to study the free radical aspects of unsaturated fatty acid autoxidation. Using ESR and ENDOR as well as selective deuteration of linoleic acid, the site of radical formation and coupling constants of all nearby hydrogens were extracted. Thus, ENDOR may prove to be quite useful in determining primary radical structure in spin trapping experiments.

Mossoba et al.[5] have used out-of-phase ESR, i.e. 90° out-of-phase detection, to study the long-range proton hyperfine coupling constants of DMPO. This approach allowed the determination of the hyperfine coupling constants of all the protons (as well as the deuterium, when present) for the ·COOH, ·CH_3, ·CD_3, ·OH and ·OD spin adducts. The superhyperfine coupling constants of the distant protons are small, less than one-half gauss; thus, oxygen must be excluded to produce the narrow linewidths required for successful analysis. They demonstrated that deuterated DMPO (although not yet synthesized and studied) in out-of-phase ESR experiments could be a useful tool for the identification of unknown radicals.

Isotopic labelling using ^{13}C, ^{15}N or ^{17}O has been of great value in the identification of spin adducts. These labelled spin adducts present a different multiplicity in the ESR spectrum from that usually observed with ^{12}C, ^{14}N or ^{16}O. Labelled spin adducts are clearly indicated in this tabulation.

ESR spectra from spin trapping experiments often require simulation to extract the hyperfine coupling constants. This is especially true if the spectrum consists of more than one component. A flexible and efficient computer program that is designed for use with microprocessors is presented by Oehler and Janzen.[6] This program easily handles the routine spectra obtained in spin trapping experiments.

Solvent effects. The solvent can have a major effect on the hyperfine splitting observed for a spin adduct. In fact, changes in solvent can produce a larger effect on the observed hyperfine splitting than changes in the spin adduct structure. (Thus, researchers need to clearly state the exact nature of the solvent used during the collection of ESR spectra in spin trapping experiments.) In general, increases in solvent polarity produce an increase in the nitrogen-hyperfine splitting as the spin density on the nitrogen increases. Thus, the β-hydrogen splitting will usually (but not always) decrease. At present, there is no theoretical approach to accurately predict how A_N and A_H will change with the nature of the solvent. However, empirical approaches are being investigated. Janzen et al.[7] have demonstrated that for a particular spin adduct in different solvents, A_H and A_N can be linearly correlated with excellent correlation coefficients. (When available, these linear relationships are included in the tables.) In addition, the hyperfine splittings can often be linearly correlated with physical-chemical parameters of the solvent. Thus, in principle, both A_N and A_H can be predicted for a spin adduct in any solvent from just a few measurements. However, this area of research is in its infancy. The best means of spin adduct identification still lies in a comparison to previously identified adducts or through well-defined chemistry in the same solvent.

Tables of spin adduct ESR parameters

The following tables summarize the hyperfine splitting constants of spin adducts. In addition, isotropic

[1] See Refs. 85JA01 and 82JA01.
[2] See Ref. 86TH01.
[3] See Refs. 77KO01, 82KO04, 84JA04, and 86JA01 (and references therein).
[4] See Refs. 84EV01 and 85EV01.
[5] See Ref. 84MO04.
[6] See Ref. 82OE01.
[7] See Refs. 78JA01 and 82JA01.

g-values are given when measured, as well as a brief comment on the source of the radical. The units chosen for this tabulation of ESR hyperfine coupling constants are gauss, G. The SI unit for magnetic flux density is tesla, T. To convert from gauss to tesla use

$$T = 1 \times 10^{-4} G$$

or for millitesla

$$mT = 0.1 G$$

Thus, the conversion from one unit to another is quite simple.

The assignment for the trapped radicals presented in these tables is as interpreted by the authors of the original papers. If the radical is given in quotes, e.g. "'OH", the authors have interpreted the experiments to mean that this radical has not been formed, but rather the chemistry of the experiment has resulted in the formation of a spin adduct as if the radical were formed. As research continues in the area of free radical biology and medicine, a reinterpretation of some published data may be appropriate. This appears especially to be true with regard to oxygen-centered radicals.

Although these tables contain a large number of entries, they by no means are intended to provide a complete summary of the spin trapping literature. Only a small portion of the early work is included here as the Landolt–Börnstein series (see Ref. 79FO01) contains tabulations of spin adduct spectral parameters (up to 1978) as an integral part of their summary of the nitroxide radical data. The literature now contains over 100 compounds that are of potential use as spin traps; thus, researchers should not confine themselves to only those spin traps included in this summary if other spin traps would provide an experimental advantage. A computer data base of spin adduct spectroscopic parameters is being assembled (DuBose and Janzen, in preparation). This will certainly complement this tabulation and provide a means for continuous updating as spin trapping research evolves.

There are now many excellent reviews on various aspects of spin trapping. These are listed in the references and are noted with an asterisk that preceeds the reference code.

Happy Spin Trapping!

Table 1. DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
H·	Benzene	14.43	18.89(2)	photolysis of tri-*n*-butyl tin hydride	73JA01
H·	Toluene	14.43	18.90(2)	photolysis of alkyl cobalt(III) complexes	78MA01
H· and e^- + H·	W	16.7	22.6(2)	radiolysis of water	76SA01
e^- + H·	AcN	16.10	22.75(2)	Ti(III)-citrate + H_2O_2	80SC01
H·	W(7)	16.6	22.6(2)	4-aminobenzoic acid + UV light	81CH01
e^- + H·	W	16.58	22.50(2)	[2.0054], sulfite + light, $t_{1/2}$ = 36 s	81KI01
e^- + H· (reduction)	W(P7)	16.0	21.5(2)	sodium borohydride reduction then oxidation	81LO01
e^- + H·	W(12)	16.0	22.0, 21.8	gamma irradiation of water	82HE01
e^- + H·	W(TR7.0)	16.6	22.5(2)	[2.0054] DOPA or catechol + UV	82KA01
H·	W	16.6	22.5(2)	ultrasound in water	85RI01, 82MA01
H·	W	16.6	22.5(2)	ultrasound in water	85RI01, 83MA01
H·	W(10)/EtOH 3:2	16.5	22.5(2)	chlorohemin + light	83MA02
H·	W	16.6	22.5(2)	ultrasound with clinical equipment	83MA05
H·	Toluene	14.33	18.99(2)	cobaltoxime photolysis	82MA06
e^- + H·(reduction)	W(P7.4)	16.7	22.5(2)	reduction of DMPO by isoniazid + HRP	83SI01
e^- + H·	W(P7.0)	16.7	22.4(2)	chloropromazine + UV light	84DE01
e^- + H·	W(P7.0)	16.7	22.4(2)	photolysis of tartrazine	84ME01
H·	W	16.6	22.4(2)	ultrasound	84RE09
e^- + H·	W(P6.5)	16.4	22.7(2)	CPZ + 270 nm light	85MO01
e^- + H·	W(7)	16.50	22.50(2)	UV irradiation of Trp	86HO01
H·	W(P7.8)	16.6	22.5(2)	ultrasound	86MA01
H·	W(P7.8) and LPC	15.5	23.4(2)	LPC or serum autoxidation	86MA01
H·	W(P7.0)	16.7	22.4(2)	minocycline + UV light	86PI01
e^- + H· or H·	W(P7.5)	16.6	22.5(2)	cysteinyl dopa + UV	86PI02
H·	W and Cells	16.5	22.6(2)	radiolytic generation	86SA01
D·	D_2O	16.7	22.6	A_D = 3.3, radiolysis of D_2O	76SA01
D·	D_2O(7)	16.6	22.6	A_D = 3.4, 4-aminobenzoic acid + light	81CH01

Table I (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
e^- + D$^+$	D_2O(12)	16.0	21.87	A_D = 3.3, gamma irradiation of D_2O	82HE01
e^- + D$^+$	D_2O(7)	16.6	22.5	A_D = 3.4, [2.0054] photolysis of DOPA	82KA01
D$^\cdot$	Toluene	14.33	18.99	A_D = 2.83, cobaltoxime photolysis	82MA06
D$^\cdot$	D_2O	16.6	22.5	A_D = 3.4, ultrasound in D_2O	85RI01, 82MA01
D$^\cdot$	D_2O	16.6	22.5	A_D = 3.4, ultrasound in D_2O	85RI01, 83MA01
e^- + D$^+$	D_2O(7)	16.50	22.50	A_D = 3.4, UV irradiation of Trp	86HO01
$^\cdot CH_3$	Benzene	14.31	20.52	CH_3HgI + light	73JA01
$^\cdot CH_3$	W	16.33	23.24	[2.0052], acetate + $SO_4^{\cdot-}$	81KI01
$^\cdot CH_3$	W(P7.4)	16.4	23.4	H_2O_2 + UV + DMSO	82FI01
$^\cdot CH_3$	W(P7.8)	16.50	23.75	adriamycin semiquinone + *t*-BuOOH or $Ph(CH_3)_2COOH$	84KA01
$^\cdot CH_3$	W	16.1	23.0	A_H = 0.473(3), 0.237(6), 0.140(2), 0.238, 0.302; H_2O_2 + DMSO + UV, 90° out-of-phase detection	84MO04
$^\cdot CH_3$ or $C_6H_4C^\cdot H_2$	W(P7.5)	16.3	23.5	procarbazine + HRP	84SI02
$^\cdot CH_3$	W/DMSO 19:1	16.1	23.0	diaziquone + DMSO + light	85MO02
$^\cdot CH_3$	W(P7.4)	16.4	23.4	PQR and *Trypanosoma cruzi* and NADH	86AU01
$^\cdot CH_3$	Hanks	15.31	22.00	stimulated neutrophils with DMSO	86BR02, 86BR01
$^\cdot CH_3$	W(HEPES7.4)	16.3	23.4	*tert*-BuOH + mitochondria	86KE01
$^\cdot CD_3$	W	16.1	23.0	A_H = 0.237(6), 0.140(2), 0.238, 0.302, A_D = 0.072(3); DMSO + H_2O_2 + UV, 90° out-of-phase	84MO04
$^\cdot CH_2OH$	Benzene	14.66	20.67	MeOH + BP*	73JA01
$^\cdot CH_2OH$	W	16.	22.7	radiolysis of water with MeOH	76SA01
$^\cdot CH_2OH$	W(6)	15.95	22.69	H_2O_2 + light and MeOH	80MA02
$^\cdot CH_2OH$	W	15.87	22.57	[2.0053] $SO_4^{\cdot-}$ + MeOH	81KI01
$^\cdot CH_2CH_3$	Benzene	14.20	20.49	$(C_2H_5)Hg$ + light	73JA01
$^\cdot CH_2CH_3$	W(C10.0)	16.2	23.6	Cu catalyzed oxidation of ethylhydrazine	81AU01
$^\cdot CH_2CH_3$	Benzene	14.0	20.5	Cu catalyzed oxidation of ethylhydrazine	81AU01
$^\cdot CH_2CH_3$	W(P7.5)	16.3	23.5	ethyl hydrazine + oxyhemoglobin or Cu(II)	82AU03
$^\cdot CH_2CH_3$	Benzene	14.2	20.5	ethylhydrazine + oxyhemoglobin or Cu(II)	82AU03
$^\cdot CH_2CH_2OH$	W	15.98	22.83	[2.0057] $SO_4^{\cdot-}$ + EtOH, $t_{1/2}$ = 4.8 min	81KI01
$CH_3C^\cdot HOH$	Benzene	15.03	22.53	EtOH + BP*	73JA01
$CH_3C^\cdot HOH$	W(P7.4)	15.8	22.8	microsomes + NADPH + 0.9% EtOH	77LA01
$CH_3C^\cdot HOH$	W(P7.5)	15.8	22.9	[2.0067] HP + light + EtOH	80BU01
$CH_3C^\cdot HOH$	W	15.8	22.8	H_2O_2 + UV light + EtOH	81RO01
$CH_3C^\cdot HOH$	W(P7.4)	15.8	22.8	H_2O_2 + EtOH + light	80FI01
$CH_3C^\cdot HOH$	W	15.8	22.9	[2.0067] Fenton system	82BU01
$CH_3C^\cdot HOH$	W	15.8	22.8	*Phanerochaete chrysosporium* cell extract + EtOH	82FO01
$CH_3C^\cdot HOH$	W(P7.4)/EtOH 9:1	15.8	22.9	autoxidation of cysteine with EtOH	82SA01
$CH_3C^\cdot HOH$	W(P7.4)/EtOH 8:1	15.7	22.4	Fe(II) + cysteine	82SE01
$CH_3C^\cdot HOH$	W(P7.4)	16.0	23.0	[2.0054] EtOH + Fe(II)	82TE01
$CH_3C^\cdot HOH$	W(B9.0)	15.8	22.8	H_2O_2 + UV or with *Methanobacterium formicicum*	83BA02
$CH_3C^\cdot HOH$	W	15.8	22.8	ultrasound in water with EtOH	85RI01, 83MA01
$CH_3C^\cdot HOH$	EtOH/W 1:1	15.0	21.7	benoxaprofen + UV light	83RE01
$CH_3C^\cdot HOH$	W(P7.0)	15.8	22.8	methylene blue + ascorbate + light	84BU01
$CH_3C^\cdot HOH$	W(HEPES 7.4)	not given		ubisemiquinone radical reactions	84NO01
$CH_3C^\cdot HOH$	W(P7.8)	16.0	23.0	H_2O_2, EtOH + drug semiquinone	84KA01
$CH_3C^\cdot HOH$	W(P7.0)	15.8	23.0	Photofrin II + ascorbate + light	85BU02
"$CH_3C^\cdot HOH$"	W	15.8	22.8	blue dye No. 1 + light with EtOH, not $CH_3C^\cdot HOH$	85CA01
$CH_3C^\cdot HOH$	W(P6.5)	15.9	23.1	CPZ + EtOH + UV light	85MO01
$CH_3C^\cdot HOH$	W(P7.4)	16.0	23.2	anthraprazole + ascorbate, Fe(III) and light	86RE02
1-Hydroxyalkyl (C$^\cdot$)	W(P7.4)	15.8	22.8	[2.0055] glyceraldehyde autoxidation	84TH04

Table 1 (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
Carbon radical	W(P7.4)	see Ref. 84TH04		glyceraldehyde autoxidation with oxyhaemoglobin	84TH06
Hydroxyalkyl	W(P6–9)	not given		glyceraldehyde autoxidation	84WO01
$^{\cdot}CH(CH_3)_2$	W(P7.4)	16.1	24.4	iproniazid + HRP or PGS	85KA02, 83SI01
$(CH_3)_2C^{\cdot}OH$ or $^{\cdot}CH_2CH(CH_3)OH$	W(6)	15.98	23.95	H_2O_2 + UV and 2-PrOH	80MA02
$(CH_3)_2C^{\cdot}OH$	W	15.92	23.66	[2.0054], $(CH_3)_2CHOH + SO_4^{\cdot-}$	81KI01
$(CH_3)_2C^{\cdot}OH$	W(TR7.4)/EtOH 8:1	15.2	22.8	Fe(II) + cysteine	82SE01
$(CH_3)_2C^{\cdot}OH$	W(P7.8)	16.0	24.1	[2.0053] iso-PrOH + Fe(II)	82TE01
$(CH_3)_2C^{\cdot}OH$	W(P11.0)	15.8	23.9	Fe(III)TPPS + 2-PrOH + light	84FA01
R'?	W(P7.4)	15.7	23.2	isoniazid + HRP	83SI01
$(CH_3)_2COHCH_2^{\cdot}$	W(7)	16.0	23.2	gamma irradiation of water, $t_{1/2}$ = 57 min	82HE01
$^{\cdot}C(OH)_2CH(OH)CH_2OH$	W(P8.5)	15.8	22.8	[2.0055] DL-glyceraldehyde autoxidation	84TH02
n-Butyl	Benzene	14.24	20.41	$(C_4H_9)_4Pb$ + light	73JA01
$^{\cdot}CH_2S(O)CH_3$	W(P8.3)	15.8	22.8	hepatic nuclei + NADPH and DMSO	80PA01
Citrate radical	W(P6.5)	15.3	18.6	CPZ + citrate + UV light	85MO01
1-Hydroxybutyl	Benzene	14.89	22.72	C_4H_9OH + BP*	73JA01
2-Hydroxypropyl	Benzene	14.58	23.91	C_3H_7OH + BP*	73JA01
$(CH_3)_2C^{\cdot}CN$	Xylene	14.6	20.4	α, α'-azobisisobutyronitrile + heat, 383 K	70WI01
Polyethylene glycol-C'	W and Cells	15.75	21.6	radiolytic generation	83SA01
Ethlene glycol-C'	W and Cells	15.6	22.5	radiolytic generation	83SA01
$^{\cdot}C(CH_3)_2CH(NH_3+)CO_2^-$	W(7.4)	15.47	20.00	photolysis of penacillamine disulfide	87DA01
$^{\cdot}CH_2CH(NH_3+)COO-$	W(P7.5)	16.0	22.5	cysteinyl dopa + UV	86PI02
L-Threonine-C'	W	15.6	23.0	gamma irradiation	83ET01
Glycine-C'	W	15.75	22.6	gamma irradiation	83ET01
L-Arginine HCl-C'	W	15.3	21.5	gamma irradiation	83ET01
β-Alanine	W	15.6	23.6	gamma irradiation	83ET01
$CO_2^{\cdot-}$	W(5.5)	15.6	18.7	chlorophyl + light with formate	78HA01
$CO_2^{\cdot-}$	W	15.8	19.1	[2.0058] ZnO dispersion + light and formate	79HA01
$CO_2^{\cdot-}$	W	15.97	18.97	[2.0054] oxalate + $SO_4^{\cdot-}$	81KI01
$CO_2^{\cdot-}$	W(P7.0)	15.6	18.8	reduced mitomycin C	81LO01
$CO_2^{\cdot-}$	W(7)	15.38	18.2	gamma irradiation of water, $t_{1/2}$ = 46 min	82HE01
$CO_2^{\cdot-}$	W(P7.0)	15.6	18.7	furocoumarin derivative + light	83DE01
$CO_2^{\cdot-}$	W	15.6	18.7	ultrasound in water with formate	85RI01, 83MA01
$CO_2^{\cdot-}$	W(P7.0)	15.6	18.7	chlorpromazine + formate and UV light	84DE01
$CO_2^{\cdot-}$	W(P11.0)	15.6	18.7	Fe(III)-TPPS + formate + light	84FA01
$CO_2^{\cdot-}$	W(P7.0)	15.6	18.7	photolysis of tartrazine with formate	84ME01
$CO_2^{\cdot-}$	W	15.6	18.7	A_H = 0.236(6), 0.130(2), 0.243, 0.275; H_2O_2 + formate + UV, 90° out-of-phase detection	84MO04
$CO_2^{\cdot-}$	W(HEPES7.4)	not given		ubisemiquinone radical reactions	84NO01
$CO_2^{\cdot-}$	W(MS7.0)	not given		pea chloroplasts + paraquat + light	85BO01
$CO_2^{\cdot-}$	W(P7.0)	15.8	18.6	Photofrin II + ascorbate + formate + light	85BU02
"$CO_2^{\cdot-}$"	W	15.6	18.7	blue dye No. 1 + light + formate, not $CO_2^{\cdot-}$	85CA01
$CO_2^{\cdot-}$	W(P6.5)	15.8	18.8	CPZ + formate + UV light	85MO01
$CO_2^{\cdot-}$	W/DMSO 19:1	15.6	18.7	diaziquone + light	85MO02
$CO_2^{\cdot-}$	W(P7.0)	15.6	18.7	chlortetracycline + UV	86PI01
$CO_2^{\cdot-}$	W(P7.4)	15.7	18.8	anthrapyrazole + NADH, formate and light	86RE01
Hydroxypyruvaldehyde (C')	W(P7.4)	14.9	19.6	[2.0056] autoxidation of hydroxypyruvaldehyde	86TH07
Sorbitol radical	W(P7.2)	15.9	22.5	ozone + caffeic acid and sorbitol	83GR02
Indole-3-($^{\cdot}CH_2$)	W(Ac4.6)	16.0	22.4	indole-3-acetic acid + HRP + H_2O_2	86MO04
$^{\cdot}CH_2C_6H_4NO_2$	W(TR7.4)	15.8	22.4	*o*-nitrobenzyl + microsomal protein	86MO02
$^{\cdot}CH_2C_6H_4NO_2$	W(TR7.4)	16.0	21.4	A_H = 0.7, *p*-nitrobenzyl + microsomal protein	86MO02

Table I (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
Uracil radical (1)	W(12)	16.0	24.5	gamma irradiation of 5-bromouracil	82HE01
Uracil radical (2)	W(12)	15.35	21.0	gamma irradiation of 5-bromouracil, $t_{1/2}$ = 17 min	82HE01
Phenyl	Benzene	13.76	19.22	phenylazotriphenylmethane	73JA01
Phenyl	W(B10.2)	15.9	24.8	[2.0045] phenylhydrazine autoxidation	81HI01
Phenyl	Benzene	13.8	19.2	[2.0045] phenylhydrazine autoxidation	81HI01
Phenyl	W(P7.0)	15.8	24.4	[2.0045] phenylhydrazine + erythocytes	81HI01
Phenyl	W	15.97	24.36	[2.0053], benzoic acid + $SO_4^{\cdot-}$, $t_{1/2}$ = 21 min	81KI01
Phenyl	W(P7.5)	16.0	24.7	phenylhydrazine and oxyhemoglobin	82AU03
Phenyl	Benzene	13.9	19.4	phenylhydrazine and oxyhemoglobin	82AU03
Phenyl	W(P7.4)	15.8	24.4	[2.0045] phenylhydrazine + erythrocytes	82HI02
Phenyl	W(P7.4)	15.8	24.4	[2.0045] phenylhydrazine + erythrocytes	83HI01
Phenyl	W(P7.4)	15.9	24.8	phenylhydrazine + HRP or PGS	83SI01
Phenyl	W(P7.4)	15.9	24.8	[2.0045] AcPhHZ + oxyhemoglobin or red cells	84TH03
2-Chlorophenyl	W(P7.5)	15.7	23.4	2-chlorophenylhydrazine and oxyhemoglobin	82AU03
2-Chlorophenyl	Benzene	13.7	18.8	2-chlorophenylhydrazine and oxyhemoglobin	82AU03
4-Chlorophenyl	W(P7.5)	15.8	24.2	4-chlorophenylhydrazine and oxyhemoglobin	82AU03
4-Chlorophenyl	Benzene	13.8	19.5	4-chlorophenylhydrazine and oxyhemoglobin	82AU03
2-Methylphenyl	W(P7.4)	15.9	23.8	2-methylphenylhydrazine and oxyhemoglobin	82AU03
2-Methylphenyl	Benzene	13.9	19.1	2-methylphenylhydrazine and oxyhemoglobin	82AU03
3-Methylphenyl	W(P7.5)	15.8	24.3	3-methylphenylhydrazine and oxyhemoglobin	82AU03
3-Methylphenyl	Benzene	14.1	19.5	3-methylphenylhydrazine and oxyhemoglobin	82AU03
Benzyl	Benzene	14.16	20.66	$(C_6H_5CH_2)_2Hg$ + light	73JA01
Benzyl	W(P7.5)	16.0	22.0	benzylhydrazine and oxyhemoglobin	82AU03
Benzyl	Benzene	14.1	20.4	benzylhydrazine and oxyhemoglobin	82AU03
α-Hydroxybenzyl	W(TAR3.0)	16.0	22.7	A(13-C) = 8.3, DMHB + ligninase	85HA03
$C_6H_5C^{\cdot}(OH)(CH_3)_2$	W(TAR3.0)	16.0	22.3	DMHB + ligninase	85HA03
$4\text{-}NH_2\text{-}C_6H_4^{\cdot}$	D_2O(9)	16.1	24.95	4-iodoaniline + UV light	81CH01
$4\text{-}H_2NO_2SC_6H_4^{\cdot}$	D_2O(7)	15.7	23.73	4-iodobenzenesulfonamide + UV light	81CH01
$4\text{-}HOOCC_6H_4^{\cdot}$	D_2O(7)	15.8	24.06	4-iodobenzoic acid + UV light	81CH01
$4\text{-}CH_3C_6H_4^{\cdot}$	W(8.5)	16.38	23.5	chloramine-T + UV light	85EV03
alpha-Cyanobenzyl	Benzene	14.39	20.63	$C_6H_5CH_2CN$ + BP*	73JA01
1-Phenylethyl	Benzene	14.20	20.49	$C_6H_5CH_2CH_3$ + BP*	73JA01
Styrene (C-7)	W(P7.6)	16.0	22.4	styrene + HRP + GSH + H_2O_2	86ST01
Benzoic acid ring C	W	15.95	23.54	[2.0053] phthalic acid + $SO_4^{\cdot-}$	81KI01
Phenyl-4-sulfonate	W(B10.2)	15.9	14.8	[2.0045] phenylhydrazine-4-sulfonate autoxidation	81HI01
P', promazyl	W(P6.5)	15.9	24.3	CPZ + UV light	85MO01
Benzoyl	Benzene	13.99	15.57	C_6H_5CHO + BP*	73JA01
Phenoxymethyl	Benzene	13.79	19.56	$C_6H_5OCH_3$ + BP*	73JA01
1-Ethoxyethyl	Benzene	14.20	20.49	$(C_2H_5)_2O$ + BP*	73JA01
Tetrahydrofuranyl	Benzene	14.12	17.92	THF + BP*	73JA01
Aminoformyl	Benzene	15.23	18.56	H_2NCHO + BP*	73JA01
Dimethylaminoformyl	Benzene	14.30	17.37	DMF + BP*	73JA01
Acetoxyl	CH_2Cl_2	12.5	10.0	A_H = 0.9, ozone + dimethylacetylene, −70°C	82PR01
Acetyl	Benzene	14.03	17.87	CH_3CHO + BP*	73JA01
Acetyl	CH_2Cl_2	14.0	17.7	ozone + dimethylacetylene, −30°C	82PR01
L'	Freon-11	13.9	20.4	ozone + methyl linoleate, −40°C	81PR01
L'	Freon-11	14.3	20.9	ozone + methyl linoleate	81PR03

Table I (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
Dimethylnitrosoamine	W(P7.4)	15.65	22.25	nitrosoamine + nuclei or microsomes	78FL01
Diethylnitrosoamine	W(P7.4)	16.00	24.00	nitrosoamine + microsomes or nuclei	78FL01
1-Nitrosopyrroline	W(P7.4)	15.50	22.80	nitrosoamine + nuclei or microsomes	78FL01
1-Nitrosopiperidine	W(P7.4)	15.45	23.70	[2.0054] nitrosoamine + nuclei or microsomes	78FL01
C·?	W(TR7.5)	15.9	21.9	[2.007] microsomes	79GR02
C·?	W	14.5	16.2	RSVM + AA	81SM01
C·?	W(EPPS8.0)	15.53	22.0	[2.0015] 1-aminocyclopropane-1-carboxylic acid and Fenton system	82LE01
C·?	W(P7.8) and LPC	16.1	24.5	LPC or serum autoxidation	86MA01
C·?	W(P7.0)	16.25	22.5	chlortetracyline + UV light	86PI01
C·?	W(P7.4)	15.9	23.0	[2.0056] hydroxypyruvaldehyde autoxidation	86TH07
$\cdot CF_3$	Benzene	13.22	15.54	A_F = 1.01(3), CF_3I + light	73JA01
$\cdot CCl_3$	W	14.6	14.6	CCl_4 + UV then water extraction	82RO02
$N_3\cdot$	W(P7.5)	14.9	14.9	A_N = 3.0, [2.006] HP + azide + light	80BU01
$N_3\cdot$	W	14.7	14.7	A_N = 3.0, e^- irradiation	80KE01
$^{15}N_3\cdot$	W	14.7	14.7	A(15-N) = 4.5, e^- irradiation	80KE01
$N_3\cdot$	W	14.5	14.5	A_N = 3.1, methylene blue + light	82HA01
$N_3\cdot$	W	16.9	16.9	A_N = 3.2, porphyrin photosensitization	84MO01
$N_3\cdot$	EtOH/W 9:1	13.7	12.2	A_N = 3.1, 2-phenylbenzoxazole + azide and UV	84RE03
$N_3\cdot$	W	14.70	14.70	A_N = 2.95, ultrasound with $[Co(NH_3)_5N_3]Cl_2$	84RE09
"$N_3\cdot$"	W	16.9	16.9	A_N = 3.2, Blue dye No. 1 + light	85CA01
$N_3\cdot$	W(P7.6)	14.8	14.2	A(14-N) = 3.1, HRP/H_2O_2 + azide	85KA01
$^{15}N_3\cdot$	W(P7.6)	14.8	14.2	A(15-N) = 4.3, HRP/H_2O_2 + azide	85KA01
$N_3\cdot$	W(P7.4)	15.0	14.3	A_N = 3.17, anthrapyrazole + NADH, azide and light	86RE01
$\cdot NH_2$ (D_2)	D_2O(9)	15.9	19.3	A_N = 1.60, sulfanilamide + UV light	81CH01
$^{15}\cdot NH_2$ (D_2)	D_2O(9)	15.9	19.3	A(15-N) = 2.24, ^{15}N-sulfanilamide + UV light	81CH01
$\cdot NH_3^+$ (D_3)	D_2O(4)	14.0	18.74	A_N = 3.13, sulfanilamide + UV light	81CH01
$^{15}\cdot NH_3^+$ (D_3)	D_2O(4)	14.0	18.74	A(15-N) = 4.40, ^{15}N-sulfanilamide + UV light	81CH01
$\cdot NH_2$	W	15.85	19.03	A_N = 1.71; [2.0054]; NH_2 + SO_4^-	81KI01
·NH-*n*-Butyl	Benzene	13.95	16.39	A_N = 1.88	78JA02
RNHN·H	W(B10)	15.0	16.7	A_N = 2.5, hydralazine X.O. or red cells	83SI02, 82SI01
RNHN·H	W(B10)	15.0	16.7	A_N = 2.56, hydralazine + HRP	83SI01
$RNHN\cdot H_2^+$	W(Ac5)	14.1	18.5	A_N = 3.1, hydralazine + HRP	83SI01
$CH_3C_6H_4SO_2N^-(Na^+)$	W(8.5)	15.87	18.13	A_N = 2.38, chloramine-T + UV light	85EV03
See 83CA02 for a very useful kinetic technique to distinguish between free and "bound" ·OH, also 86BU01.					
·OH	W	15.0	15.0	radiolysis of water	76SA01
·OH	W	15.0	15.0	[2.0062] H_2O_2 + UV light	77LA01
·OH	W(P7.4)	15.0	15.0	[2.0062] microsomes + NADPH	77LA01
·OH	W(P7.8)	not given		Fenton system	78BU01
·OH	W(P7.8)	not given		xanthine + xanthine oxidase with DETAPAC	78BU02
·OH	W(P7.4)	14.90	14.90	microsomes or nuclei and nitrosoamines	78FL01
·OH	W(P7.4)	14.90	14.90	[2.0055] H_2O_2 + UV light	78FL01
·OH	W(5.5)	14.9	14.9	[2.0061] chlorophyll a or Bchl + light	78HA01
·OH	W	14.77	14.77	ammonium persulfate	78JA02
·OH	W	14.83	14.83	ADP-Fe(III)-H_2O_2	78JA02

Table 1 (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
'OH	W(P7.4)	15.0	15.0	[2.0062] microsomes + NADPH	78LA01
'OH	W(P7.4)	15.0	15.0	[2.0062] NADPH-cytochrome *c* reductase	78LA02
'OH	W(P7.4)	15.0	15.0	microsomes + NADPH	78LA02
'OH	AcN	14.10	12.29	[2.0060] $O_2^{\cdot}$ + H_2O_2	78OZ01
'OH	W(P7.8)	14.87	14.81	xanthine + xanthine oxidase	79FI01
'OH	W(P7.8)/DMF 10:1	14.8	14.8	TMAS, $t_{1/2}$ = 2.5 h	79FI01
'OH	W(P11.5)	14.9	14.9	[2.006] 6-hydroxydopamine autoxidation	79FL01
'OH	W(P)	not given		stimulated neutrophils	79GR01
'OH	W	not given		ZnO dispersion + light	79HA01
'OH	W(P7.2)	15.3	15.3	(±0.3 G), polymorphonuclear leucocytes	79RO01
'OH	W(6.9)	15.2	15.2	[2.0058] Fe(II)-bleomycin	79SU02
'OH	W(P7.5)	15.0	15.0	[2.0060], hematoporphyrin + light	80BU01
"'OH"	W(7)	not given		5-methylphenazinium + light, not 'OH	80CH01, 80CH02
'OH	W(P7.4)	14.9	14.9	H_2O_2 + light	80FI01
'OH	W	14.9	14.9	e^- irradiation	80KE01
'OH	W(6)	15.00	15.00	H_2O_2 + UV, $t_{1/2}$ = 870 s	80MA02
'OH	W	not given		neutrophiles + latex IgG	80OK01
'OH	W(P8.3)	14.9	14.9	hepatic nuclei + NADPH	80PA01
'OH	W	15.0	15.0	Ir(III), Ce(IV), Ti(IV) or $KMnO_4$	80SC01
'OH	W	15.0	15.0	hematin + cumenehydroperoxide	80SC01
'OH	W	15.01	15.01	Fe(II)-citrate + H_2O_2	80SC01
'OH	W(6.9)	15.2	15.2	[2.0058] Fe(II)-bleomycin	80SU01
'OH	Hanks	not given		neutrophiles + zymoson	81AR01
'OH	W(7)	15.1	15.1	4-aminobenzoic acid + UV light	81CH01
'OH	W(7–11)	14.90	14.90	[2.0057] H_2O_2 + light or $SO_4^{\cdot-}$, $t_{1/2}$ = <5 s	81KI01
'O⁻	W(13.5)	16.2	16.2	[2.0057] H_2O_2 + light; pH dependence of A's	81KI01
'OH	W(P7)	15.0	15.0	reduced mitomycin C	81LO01
'OH	W(P7.4)	14.95	14.95	respiring mitochondria	81NO01
'OH	W	14.9	14.9	H_2O_2 + UV light	81RO01
'OH	W	14.9	14.9	[2.0061] Fenton system	82BU01
'OH	W(P7.4)	14.9	14.9	H_2O_2 + UV or decomposition of DMPO-OOH	82FI01
'OH	W(7.4)	14.9	14.9	Fenton system, buffer and chelate effect shown	82FL01
'OH	W	14.9	14.9	[2.006] Phanerochaete chrysosporium extract	82FO01
'OH	W(P7.4)	14.8	14.8	daunomycin + light	82GR01
'OH	W(7)	14.7	14.7	gamma radiation of water, $t_{1/2}$ = 58 min	82HE01
'OH	W(7.0)	14.9	14.9	[2.0055] DOPA or catechol + UV	82KA01
"'OH"	W	14.9	14.9	air oxidation of DMPO	82LI03
'OH	W	14.9	14.9	ultrasound in water	85RI01, 82MA01
'OH	W(7.8)	not given		Fe(III)-EDTA + H_2O_2	82MA02
'OH	W(P7.4)	14.9	14.9	[2.0050] autoxidation of cysteine	82SA01
'OH	W(TR7.4)	14.8	14.8	Fe(II) + cysteine	82SE01
'OH	W(P7.8)	15.0	15.0	[2.0056] Fenton system	82TE01
'OH	W(P7.4)	14.9	14.9	[2.0050] red blood cells + adriamycin	83BA01
'OH	W(P7.8)	not given		Fe(II)-picolinate + H_2O_2	83BA03
'OH	W(P7.4)	15.0	15.0	Fe(II)-EDTA or Fe(II)-DETAPAC + H_2O_2	83BU01
"'OH"	W	14.9	14.9	adriamycin or daunomycin + light, not 'OH	83CA01
'OH	W(P7.4)	14.9	14.9	[2.0050] reduced nucleotide and phenazines	83DA01
'OH	W(P7.0)	14.9	14.9	Furocoumarin derivatives + light	83DE01
"'OH"	W(RPMI)	15.02	15.02	human polymorphonuclear leukocytes	83DO02
'OH	W(CH7.0)	14.92	14.92	Fenton system	83FL01
'OH	1-octanol	14.2	11.6	Fenton system in water then extraction	83FL01

Table 1 (*Continued*). DMPQ Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
·OH	W(CH6.7)	14.92	14.92	Fe(II)-ADP-H_2O_2	83FL02
·OH	W(CH6.7)	14.92	14.92	Fe(II)-ADP-H_2O_2	83FL03
·OH	W(P7.2)	not given		ozone + caffeic acid	83GR02
·OH	W(KRP7.4)	14.8	14.8	stimulated peripheral blood neutrophiles	83HA01
·OH	W	14.9	14.9	ultrasound using clinical equipment	83MA05
·OH	W(P7.4)	14.7	14.7	xanthine oxidase with transferrin	83MO01
·OH	W(HEPES7.6)	not given		microsomes + adriamycin + NADH	83NO01
·OH	W(P7.4)	14.9	14.9	[2.0051] primaquine + red cells or NADPH	83TH02
·OH	Oleic acid	13.9	13.6	Fenton reaction	84BO01
·OH	Methyl oleate	14.5	15.0	Fenton reaction	84BO01
·OH	W(P7.0)	15.0	15.0	methylene blue + ascorbate + light	84BU01
·OH	W(7.0)	14.9	14.9	chlorpromazine + UV light	84DE01
·OH	W(P11.0)	14.9	14.9	Fe(III)-TPPS + light	84FA01
·OH	W(TR7.6)	not given		H_2O_2 + light, HPLC detection method given	84FL01
·OH	W(P7.4)	not given		xanthine oxidase, iron and membranes	84GI01
·OH	W(P7.8)	14.95	14.95*	Fenton system	84KA01
·OH	W/PrOH 1:1	14.7	13.1*	Fenton system	84KA01
·OH	W/Acetone 1:1	14.6	13.2*	Fenton system	84KA01
·OH	W/PrOH 1:2	14.5	12.65*	Fenton system	84KA01
·OH	W/Acetone 1:2	14.55	12.55*	Fenton system	84KA01
·OH	*t*-BuOH	14.6	12.0*	Fenton system	84KA01
·OH	iso-Amyl alcohol	14.25	12.0*	Fenton system	84KA01
·OH	Ethyl acetate	13.75	10.95*	Fenton system	84KA01
·OH	Benzene	13.7	12.1*	Fenton system	84KA01
·OH	Toluene	13.75	12.1*	Fenton system	84KA01
·OH	W(P7.8)	15.00	15.00	[2.0055] H_2O_2 + drug semiquinone	84KA02
·OH	W(P7.0)	14.9	14.9	photolysis of tartrazine	84ME01
·OH	W	14.9	14.9	A_H = 0.227(OH), 0.224(6), 0.135(2), 0.229, 0.370; H_2O_2 + UV, 90° out-of-phase detection	84MO04
·OD	D_2O	14.9	14.9	A_D < 0.01, A_H = 0.224(6), 0.135(2), 0.229, 0.370; H_2O_2 + UV, 90° out-of-phase detection	84MO04
·OH	W(TR7.5)	14.9	14.9	adriamycin-Fe(III) + H_2O_2	84MU01
·OH	W(HEPES7.4)	not given		ubisemiquinone radical reactions	84NO01
·OH	W	14.95	14.95	ultrasound	84RE09
"·OH"	W(P7.4)	14.9	14.9	menadione + NADPH-cytochrome *c* reductase + NADPH + GSH and GSH-peroxidase; reduction of DMPO/OOH	84RO01
·OH	W(P7.5)	15.0	15.0	enzymatic reduction of quinoids	84TE01
·OH	W(P8.5)	14.9	14.9	[2.0051] DL-glyceraldehyde autoxidation	84TH02
·OH	W(P7.4)	14.9	14.9	[2.0050] AcPhHZ + oxyhaemoglobin or red cells	84TH03
·OH	W(PP8.6)	14.9	14.9	[2.0051] glyceraldehyde autoxidation	84TH04
·OH	W(P6–8)	(14.9–15.2)		asbestos + H_2O_2	84WE01
·OH	W(P8.6)	not given		glyceraldehyde autoxidation	84WO01
·OH	W(P7.8)	14.8	14.8	xanthine + xanthine oxidase	84UE02
·OH	W(CH7.1)	14.92	14.92	ADP-Fe(II)-H_2O_2	84ZS01
·OH	W(7.1)	14.9	14.9	[2.0055] photodecomposition of bleomycin	85AN01
·OH	W(P7.0)	15.0	15.0	Photofrin II + ascorbate + light	85BU02
"·OH"	W	14.9	14.9	[2.0061], blue dye No. 1 + light, not ·OH	85CA01
·OH	W(P7)	14.9	14.9	photolysis of mitomycin C	85CA03
·OH	W(TR3.0)	14.9	14.9	Fenton system—not from ligninase	85KI01
·OH	W/AcN 3:5	14.86	14.86	cyclic peroxide decomposition	85MA03
·OH	W(P)	not given		Fenton system	85ME01
·OH	W(P3.5)	14.8	14.8	[2.006], H_2O_2-MNNG + light	85MI03
·OH	W(P6.5)	15.0	15.0	CPZ + UV light	85MO01
·OH	W/DMSO 19:1	14.9	14.9	diaziquone + light	85MO02

Table 1 (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
·OH	In cells	14.4	14.4	H_2O_2 + UV after DMPO is in cells	85MO03
·OH	W(TR7.8)	not given		H_2O_2 + UV, HPLC separation of products	85PR01
·OH	W(P7.8)	14.9	14.9	[2.0050] xanthine + xanthine oxidase	85TH01
·OH	W(7.0)	14.8	14.8	xanthine oxidase and ferritin	85TH03
·OH	W(PP8.5)	not given		monosaccharide autoxidation	85TH04
·OH	W(P7.4)	14.9	14.9	[2.0050] 1,4-naphthoquinone-2-sulfonate oxidase	85TH05
·OH	W(P7.8)	14.9	14.9	[2.0050] xanthine oxidase	85TH06
·OH	W(P7.4)	14.9	14.9	[2.0050] adriamycin + heart sarcosomes	85TH08
·OH	W(P7.4)	14.9	14.9	PRQ + *Trypanosoma cruzi* + NADH	86AU01
·OH	W	15.0	15.0	Fe(II) with Desferal + H_2O_2	86BO01
·OH	Hanks	14.9	14.9	stimulated neutrophils	86BR02, 86BR01
·OH	W(P7.0)	14.9	14.9	CPZ-SO or PZ-SO + light	86BU01
·OH	W(P7.4)	14.9	14.9	Anthracycline + submitochondrial particles	86DO01
·OH	W(P8.3)	14.9	14.9	Fenton system or peroxisomes + CoA	86EL02
·OH	W(C9.0)	not given		melanin with hydrogen peroxide	86HI01
·OH	W(7)	14.9	14.9	UV irradiation of Trp	86HO01
·OH	W(P7.8)	14.9	14.9	ultrasound	86MA01
·OH	W(Swim's)	14.9	14.9	menadione + enterocytes, DMPO/OOH reduction	86MA02
·OH	W(P7.8) + LPC	14.3	14.3	LPC or serum autoxidation	86MA01
·OH	W(P7.4)	14.7	14.7	Fenton reaction	86MO01
·OH	W(P7.4)	15.01	15.01	xanthine + xanthine oxidase and Fe(II)	86MO03
[^{17}O] ·OH	W(P7.4)	15.01	15.01	A(17-O) = 4.66, xanthine oxidase	86MO03
·OH	W(Ac4.6)	14.8	14.8	indole-3-acetic acid + HRP + H_2O_2	86MO04
·OH	W(P7.0)	14.9	14.9	chlortetracycline + UV light	86PI01
·OH	W(P7.4)	15.0	15.0	anthrapyrazole + light and NADH	86RE01
·OH	W(P7.4)	15.0	15.0	anthrapyrazole + light and ascorbate	86RE02
·OH	W and Cells	14.9	14.9	radiolytic generation	86SA01
·OH	W(P7.4)	14.9	14.9	[2.0050] NADH/NADH dehydrogenase + adriamycin	86TH02
·OH	W(P7.8)	14.9	14.9	xanthine + xanthine oxidase	**86TU01
·OH	W(7.0)	14.9	14.9	[2.006] Fenton system	87MI01
·OH	W(P7.8)	not given		xanthine + xanthine oxidase	87SI01
·OH	Ethyl acetate	13.60	10.87	reevaluation of 84KA01	87TR01
·OOH	W	14.3	11.7	A_H = 1.25, [2.0061] chloroplasts + light	75HA01
·OOH	W	14.1	11.3	A_H = 1.25, [2.0061] CdS dispersion + light	77HA01
·OOH	W(P)	not given		riboflavin + light; $t_{1/2}$ = 35–80 s for pH = 8–6	78BU01
·OOH	W(P7.8)	not given		xanthine + xanthine oxidase with DETAPAC	78BU02
·OOH	W	not given		synthetic melanin + light	78FE01
·OOH	W	14.1	11.3	CdS or phthalocyanine pigments + light	78HA02
·OOH	Ethylene glycol	13.6	10.9	CdS or phthalocyanine pigments + light	78HA02
·OOH	MeOH	13.3	10.4	CdS or phthalocyanine pigments + light	78HA02
·OOH	EtOH	13.1	10.3	CdS or phthalocyanine pigments + light	78HA02
·OOH	AcN	13.0	10.3	CdS or phthalocyanine pigments + light	78HA02
·OOH	DMSO	12.7	10.3	CdS or phthalocyanine pigments + light	78HA02
·OOH	DMF	12.8	9.9	CdS or phthalocyanine pigments + light	78HA02

Table 1 (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
·OOH	Acetone	13.1	8.1	CdS or phthalocyanine pigments + light	78HA02
·OOH	Benzene	12.9	6.9	CdS or phthalocyanine pigments + light	78HA02
·OOH	Heptane	12.9	6.8	CdS or phthalocyanine pigments + light	78HA02
$O_2^{\cdot-}$	AcN	14.20		[2.0058] electrochemical generation of $O_2^{\cdot-}$	78OZ01
·OOH	AcN	13.26	10.61	A_H = 1.25, [2.0061] electrochemical generation	78OZ01
·OOH	W(TR7.5)	as in 74HA01		microsomes + aromatic nitrocompounds	78SE01
·OOH	W(P7.0)	not given		protoporphyrin IX + light	79BU01
·OOH	different	not given		porphyrins and light	79CO01
·OOH	W(P7.8)/DMF 10:1	14.2	11.6	A_H = 1.2, TMAS	79FI01
·OOH	W(P7.8)	14.3	11.7	A_N = 1.25, xanthine + xanthine oxidase	79FI01
·OOH	W(P)	not given		stimulated neutrophils	79GR01
·OOH	W(TR7.4)	14.3	11.7	A_H = 1.25, microsomes + mitomycin C	80KA01
·OOH	W	not given		neutrophiles + latex IgG and PMA	80OK01
·OOH	W(TR7.4)	14.3	11.7	A_H = 1.25, microsomes + ronidazole	80PE02
·OOH	W(P7.5)	not given		chloroplasts and chloroplasts lipid vesicles	80UA01
·OOH	W(P7.8)	14.3	11.7	A_H = 1.3, FMN + NADPH, xanthine + X.O., riboflavin	81GR01
·OOH	W(P7.4)	14.25	11.3	A_N = 1.4, respiring mitochrondria	81NO01
·OOH	W(P7.4)	14.3	11.7	A_H = 1.25, microsomes + NADPH	81RO01
·OOH	W(KRP7.4)	14.3	11.7	A_H = 1.25 [2.0061] NADPH oxidase + NADPH or NADH	82BA01
·OOH	W(P7.8)	not given		xanthine oxidase with lactoferrin present	82BA02
·OOH	W(P7.8)	14.2	11.2	A_H = 1.3 [2.0060] xanthine oxidase	82BU01
·OOH	W	not given		xanthine oxidase; cacodylate buffer radical	82TH01
·OOH	W(P7.8)	not given		xanthine oxidase	83BA03
·OOH	W(P7.5)	14.3	11.7	A_H = 1.25, [2.0061] NADPH/pyocanine	83DA01
·OOH	W(TR7.4)	not given		arsenazo III + microsomes	83DO01
·OOH	W(P7.4)	not given		adriamycin + NADPH	83GU01
·OOH	W(Hanks)	14.3	11.7	A_H = 1.25, macrophages + PMA	83HU01
·OOH	W(Tricine8)	14.1	11.2	A_H = 1.3, chloroplasts + light	83MC01
·OOH	W(HEPES7.4)	not given		adriamycin and mitochondria	83NO01
·OOH	Benzene	12.8	6.9	A_H = 1.7, benoxaprofen + UV	83RE01
·OOH	EtOH	13.1	10.3	A_H = 1.4, benoxaprofen + UV	83RE01
$O_2^{\cdot-}$	DMSO	12.9	10.2	A_H = 1.5, benoxaprofen + UV	83RE01
·OOH	W(P7.4)	14.3	11.7	A_H = 1.25, [2.0061] primaquine + NADPH	83TH02
·OOH	W(MS7.8)	not given		pea chloroplasts, dioxathiadiaza-2,5-pentalene	84BO03
·OOH	W(P7.4)	14.3	11.35	A_H = 1.25, gentian violet + NADH + light	84FI01
·OOH	W(P7.4)	not given		nitrofurans + *Trichomanas foetus*	84MO02
·OOH	W(P7.4)	not given		nitrofurans + rat liver mitochondria	84MO03
·OOH	W(P7.4)	not given		arsenazo III + motochondrial protein	84MO07
·OOH	W(TR7.4)	14.3	11.7	A_H = 1.25, adriamycin + mitochondria + NADH	84PO01
·OOH	W(P7.4)	14.3	11.7	A_H = 1.25, menadione + NADPH-cytochrome c reductase	84RO01
·OOH	W(P7.4)	14.3	11.7	A_H = 1.25, microsomes + nitrazepam	84RO04
·OOH	W(TR7.4)	14.3	11.7	A_H = 1.2, hepatic nuclei + adriamycin	84SI01

Table 1 (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
·OOH	W(P7.5)	14.2	11.4	A_H = 1.3, enzymatic reduction of quinoids	84TE01
·OOH	W(TR7.5)	14.3	11.7	A_H = 1.25, [2.0061] naphthols + microsomes	84TH05
·OOH	W/DMSO 19:1	14.2	11.6	A_H = 1.2, KO_2 in DMSO	84UE01
·OOH	W(P7.4)	14.2	11.6	A_H = 1.2, xanthine + xanthine oxidase	84UE02
·OOH	DMSO	12.7	10.3	A_H = 1.3, Ga-phthalocyanine + light	85BE01
·OOH	W(MS7.0)	not given		pea chloroplasts + paraquat	85BO01
$O_2^{\cdot-}$	DMSO	12.7	10.3	A_H = 1.3, photolysis of aminoquinone drugs	85CA03
·OOH	W(P7.0)	14.1	11.3	A_H = 1.25, photolysis of mitomycin C	85CA03
·OOH	W(P7.4)	not given		dihydroxyfumarate, HRP + and − H_2O_2	85FI01
·OOH	W(Cit4.0)	14.2	11.3	A_H = 1.3, CPZ + UV light	85MO01
·OOH	W(TR7.8)	not given		H_2O_2 + UV, HPLC separation of products	85PR01
·OOH	W(P7.8)	14.3	11.7	A_H = 1.25, [2.0061] xanthine + xanthine oxidase	85TH01
·OOH	W(7.0)	13.1	11.0	A_H = 1.3, xanthine oxidase	85TH03
·OOH	W(P7.8)	14.3	11.7	A_H = 1.25 [2.0061] xanthine oxidase	85TH06
·OOH	W(Hanks)	14.3	11.7	A_H = 1.25, stimulated neutrophils	86BR02, 86BR03
·OOH	W(P8.0)/DMSO 1:1	12.7	10.3	A_H < 0.5, potassium superoxide	86KO01
·OOH	W(P7.4)	not given		dihydroxyfumarate + HRP (not with acetaminophen)	86MA03
·OOH	W(TR7.4)	not given		microsomes with nitrobenzyl chloride	86MO01
·OOH	W(TR7.4)	not given		*p*-nitrobenzyl chloride + microsomes	86MO02
·OOH	W(P7.4)	14.2	11.34	A_H = 1.25 xanthine oxidase	86MO03
·OOH	W(Ac4.6)	14.4	11.3	A_H = 1.3, indole-3-acetic acid + HRP + H_2O_2	86MO04
[^{17}O] ·OOH	W(P7.4)	14.2	11.34	A_H = 1.25, A(17-O) = 5.9, xanthine oxidase and $^{17}O_2$	86MO03
·OOH	AcN-wet	not given		KO_2 or ubisemiquinone radical reactions	86NO01
·OOH	W(P7.4)	14.4	11.4	A_H = 1.3, anthrapyrazole + NADH and light	86RE01
·OOH	W(P7.4)	14.3	11.7	A_H = 1.2, MPP^+ with NADH and cytochrome P450 reduction	86SI01
·OOH	W(P7.4)	14.3	11.7	A_H = 1.25, [2.0061] adriamycin + NADH dehydrogenase	86TH02
·OOH	W(P7.8)	14.3	11.7	A_H = 1.25, xanthine + X.O.	**86TU01
·OOH	W/Act 1:1	14.3	11.7	A_H = 1.25. chloroplasts + light	86YO01
$CH_3O^{\cdot}$	Benzene	13.58	7.61	A_H = 1.85, CH_3OH + $PbOAc_4$	73JA01
$CH_3CH_2O^{\cdot}$	Benzene	13.22	6.96	A_H = 1.89, EtOH + $PbOAc_4$	73JA01
$CH_3CH_2O^{\cdot}$	EtOH	13.5	7.4	A_H = 1.7, benoxaprofen + UV light	83RE01
n-Butoxyl	Benzene	13.61	6.83	A_H = 2.06, *n*-BuOH + $PbOAc_4$	73JA01
tert-Butoxyl	Benzene	13.11	7.93	A_H = 1.97, di-*t*-butylperoxalate	73JA01
tert-BuO·	Benzene	13.19	8.16	A_H = 1.82, di-*tert*-butylperoxide	†82HA01
tert-BuO·	Di-*t*-BuOOH	13.01	6.63	A_H = 2.04, di-*tert*-butylperoxide	†82HA01
tert-Butoxyl	30 different	12.77–14.84	6.13–16.03	A_H = 1.23–2.15 A_H = 3.96A_N−44.2, A_H = −0.484A_N−8.21	82JA01
tert-Butoxyl	W(P7.4)	14.8	16.0	[2.0045) erythrocytes + *t*-BuOOH	83TH01
tert-Butoxyl	Benzene	13.5	8.0	A_H = 2.2, mainstream cigarette smoke	85HA02
tert-Butoxyl	Toluene	13.08	7.44	A_H = 1.68, photolysis of hydroperoxide	86DA02
Benzoyloxyl	Benzene	12.24	9.63	A_H = 0.87(2), $(C_6H_5CO_2)_2$	73JA01
Cumene alkoxyl	Toluene	13.08	8.88	A_H = 1.68, dicumyl peroxide photolysis	86DA02

Table 1 (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
LO·	Freon-11	13.0	6.5	A_H = 1.6, methyl linoleate + ozone	81PR03
Oleic alkoxyl	Toluene	12.84	6.48	A_H = 1.68, peroxidized oleic acid + UV	86DA02
Linoleic alkoxyl	Toluene	12.84	6.48	A_H = 1.68, peroxidized linoleic acid + UV	86DA02
Linolenic alkoxyl	Toluene	12.84	6.48	A_H = 1.68, peroxidized linolenic acid + UV	86DA02
Arachidonic alkoxyl	Toluene	12.85	6.48	A_H = 1.68, peroxidized arachidonic acid + UV	86DA02
Vitamin K semiquinone	EtOH/W 4:1(6)	14.5	14.5	vitamin K_1 and oxygen	82ES01
C_2H_5OO·	W(P7.5)	14.6	11.0	A_H = 1.25, hematin + ethyl hydroperoxide	83KA01
RCO·?	W(P7.4)	15.6	18.8	isoniazid + HRP	83SI01
tert-BuOO·	W(P7.4)	14.5	10.5	A_H = 1.5, *t*-BuOOH + haemin	83TH01
tert-BuOO·	Toluene	12.72	9.36	A_H = 1.44, *tert*-butylhydroperoxide + UV	86DA02
$(CH_3)_2CHOO$·	W(P7.4)	14.7	11.5	A_H = 1.1, iproniazid + HRP	85KI01, 83SI01
Dioxyl unidentified	W(TAR5.0)	14.5	11.5	A_H = 1.3, DMHB + ligninase	85HA03
Cumenedioxyl	W(3.0)	14.5	10.75	A_H = 1.75, cumene hydroperoxide-hematin	80RO01
Cumenedioxyl	Toluene	13.92	11.20	cumene hydroperoxide + UV	86DA02
Oleyl dioxyl	Oleic acid	14.7	11.6	Fenton reaction	84BO02
Lipid dioxyl	Methyl oleate	12.62	10.25	A_H = 1.41, Fenton reaction, Spectra of LOO· in methyl laurate and linoleate also shown	84BO02
Oleic dioxyl	Toluene	14.80	12.60	peroxidized oleic acid + UV light	86DA02
Linoleic dioxyl	Toluene	14.80	12.60	peroxidized linoleic acid + UV light	86DA02
Linolenic dioxyl	Toluene	14.80	12.60	peroxidized linolenic acid + UV light	86DA02
Arachidonic dioxyl	Toluene	14.80	12.60	peroxidized arachidonic acid + UV light	86DA02
Vitamin K dioxyl	EtOH/W 4:1(6)	13.4	10.8	A_H = 1.3, vitamin K_1 quinol + oxygen	82ES01
CCl_3OO·	W	14.5	10	A_H = 1.3, CCl_4 + UV, water extraction	82RO02
See 87DA02 for additional alkoxyl and dioxyl adducts of DMPO.					
F·	Benzene	10.83		A_F = 21.6(2), A_H = 1.74(2), difluoro DMPO; AgF_2	73JA01
Cl·	Benzene	19.67		A_{Cl} = 3.57(2), from chlorine	73JA01
Thiyl radical	W(HEPES7.4)	15.2	16.4	*tert*-BuOOH + mitochondria	86KE01
CH_3S·	W(7.4)	15.33	18.00	photolysis of disulfide	87DA01
CH_3CH_2S·	W(7.4)	15.33	17.07	photolysis of disulfide	87DA01
$HOCH_2CH_2S$·	W(7.4)	15.20	16.80	A_H = 0.53(2), 2-mercaptoethanol + H_2O_2 and UV	87DA01
$HOOCCH_2S$·	W(7.4)	15.30	17.07	2-mercaptoethanoic acid + H_2O_2 and UV	87DA01
$H_2NCH_2CH_2S$·	W(7.4)	15.20	17.07	A_H = 0.54(2), 2-mercaptoethylamine + H_2O_2 UV	87DA01
$HOOC(CH_2)_2S$·	W(7.4)	15.32	17.12	photolysis of disulfide	87DA01
$HOOC(CH_2)_3S$·	W(7.4)	15.36	17.28	photolysis of disulfide	87DA01
2-Mercaptopropionylglycine-S·	W(7.4)	15.20	15.20	2-mercaptopropionylglycine + H_2O_2 and UV	87DA01
Dithiothreitol-S·	W(7.4)	15.07	16.53	photolysis of disulfide	87DA01
6,8-Dithiooctanoic acid-S·	W(7.4)	15.40	16.13	photolysis of disulfide	87DA01
Cysteinyl	W(P7.4)	15.3	17.2	[2.0047], autoxidation of cysteine	82SA01
Cysteinyl	W(P7.8)	15.3	17.25	hematoporphyrin + cysteine + light	84BU02
Cysteinyl	W(P7.4)	15.45	17.2	genitian violet + cysteine + light	84FI01
Cysteinyl	W(P7.5)	15.3	17.0	cysteine + HRP/H_2O_2	84HA02
Cysteinyl	W	15.6, 15.2	17.7, 16.7	Decomposition of thiol nitrite	84JO01
Cysteinyl	W(P8.0)	15.2	17.0	acetominophen + HRP/H_2O_2 or PGS	84RO02
Cysteinyl	W(P8.0)	15.2	17.0	HRP + *p*-phenetidine + cysteine	85RO04
Cysteinyl	W(P7.0)	15.3	17.25	CPZ-SO or PZ-SO + cysteine + UV light	86BU01
Cysteinyl	W(7.4)	15.12	17.44	photolysis of cystine	87DA01
Homocysteinyl	W(7.4)	15.28	16.80	photolysis of homocystine	87DA01

Table 1 (*Continued*). DMPO Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
N-Acetyl cysteinyl	CH_3CN	13.7	14.3	decomposition of the thiol nitrite	84JO01
N-Acetyl cysteinyl	W(P8.0)	15.0	16.8	acetaminophen + HRP/H_2O_2 or PGS	84RO02
N-Acetyl cysteinyl	W(P8.0)	15.0	16.8	HRP + phenetidine + *N*-acetyl cysteine	85RO04
GS$^{\cdot}$	W/MeOH 3:1	14.9	15.4	decomposition of the thiolnitrite	84JO01
GS$^{\cdot}$	W(P8.0)	15.0	16.3	acetaminophen + HRP/H_2O_2 or PGS	84RO02
GS$^{\cdot}$	W(HEPES7.8)	not given		PHS + AA with GSH	85BO02
GS$^{\cdot}$	W(HEPES7.8)	14.9	15.4	RSV microsomes, aminopyrine, GSH	85EL01
GS$^{\cdot}$	W	15.0	16.3	acetaminophen or *p*-phenetidine + HRP and GSH	85RO02
GS$^{\cdot}$	W(P7.0)	not given		xanthine + X.O. + GSH	85RO03
GS$^{\cdot}$	W(P8.0)	15.0	16.3	HRP + phenetidine + GSH	85RO04
GS$^{\cdot}$	W(P7.0)	15.3	16.2	CPZ-SO or PZ-SO + GSH + UV light	86BU01
GS$^{\cdot}$	W(TR7.8)	15.4	16.2	prostaglandin H synthetase + GSH	86EL01
GS$^{\cdot}$	W(TR8.3)	15.4	16.2	RSV + GSH + AA	86EL01
GS$^{\cdot}$	W(TR7.4)	15.4	16.2	HRP + H_2O_2 + GSH	86HA02
GS$^{\cdot}$	W(P7.6)	15.4	16.2	styrene + HRP + GSH + H_2O_2	86ST01
GS$^{\cdot}$	W(7.4)	15.83	16.24	A_H = 0.60(2), glutathione disulphide + UV	87DA01
p-$ClC_6H_4S^{\cdot}$	Benzene	13.6	14.3	$t_{1/2}$ = 3.3s, photolysis of the disulfide	84IT01
p-$CH_3OC_6H_4S^{\cdot}$	Benzene	13.3	14.5	$t_{1/2}$ = 1.7s, photolysis of the disulfide	84IT01
$CH_3CH_2S^{\cdot}$	Benzene	13.4	11.6	A_H = 0.8(2), decomposition of thionitrite	84JO01
$HOCH_2CH_2S^{\cdot}$	Benzene	13.8	14.2	A_H = 0.7(2)[2.0061] thionitrite decomposition	84JO01
$(CH_3)_3CS^{\cdot}$	Benzene	13.5	11.2	decomposition of thionitrite	84JO01
$(CH_3)_2CHS^{\cdot}$	Benzene	13.4	11.2	decomposition of thionitrite	84JO01
$PhCH_2S^{\cdot}$	Benzene	13.6	11.7	A_H = 1.14(2), decomposition of thionitrite	84JO01
$Ph_3CS^{\cdot}$	Benzene	12.95	13.8	[2.0067] decomposition of thionitrite	84JO01
$SO_3^{\cdot-}$	W(7)	14.7	16.0	sulfite + UV light	81CH01
$SO_3^{\cdot-}$	W	14.55	16.16	[2.0055] sulfite + light, $t_{1/2}$ = 1.2 min	81KI01
$SO_3^{\cdot-}$	W(B7.9)	14.7	16.0	sulfite + HRP or microsomes	82MO01
$SO_3^{\cdot-}$	W(P7.8)	14.4	15.9	illuminated chloroplasts with bisulfite	85CO01
$SO_3^{\cdot-}$	W(B7.8)	14.5	16.1	HRP + bisulfite	85CO01
$SO_3^{\cdot-}$	W(8.5)	14.63	16.50	chloramine-T or sulfite + light	85EV03
$SO_3^{\cdot-}$	W(P7.4)	14.7	16.0	bisulfite autoxidation	86RE03
$SO_4^{\cdot-}$	W	13.82	10.10	A_H = 1.42, 0.83; [2.0059] $S_2O_8^{2-}$ + light $t_{1/2}$ = 21s	81KI01
The following are reported to be various oxidation or degradation products of DMPO.					
$^{\cdot}AsO_2$ DMPO degraded	W	14.44		A_{As} = 7.49, $SO_4^{\cdot-}$ + ASO_2^{-}, DMPO ring broken	84RE01
C-centered	W(P7.4)	not given		hydrolysis of DMPO colored impurity	78BU01
3-DMPO-yl	W(P7.4)	16.5	22.4	chloroperoxidase, DMPO-3C$^{\cdot}$ adding to DMPO	85KA01
DMPOX	different	6.27–6.87	3.18–3.65	solvent dependency shown	71AU01
DMPOX	W(P7.4)	7.1	4.2(2)	[2.0065] cumenehydroperoxide + hematin	77FL01
DMPOX	W and MeOH	not given		solvent dependence shown	80RO01
DMPOX	W	~7	~4	Ir(III), Ce(IV), $KMnO_4$, Ti(IV) or hematin	80SC01
DMPOX	W(P7)	7.2	4.1(2)	[2.0048] superoxo-cobalt complex	82HI01
DMPOX	W(P7.4)	7.2	4.1(2)	*tert*-BuOOH + haemin	83TH01
DMPOX	W(7.6)	7.1	4.2(2)	porphyrin photosensitization	84MO01
DMPOX	W(P7.4)	7.2	4.1(2)	[2.0048] AcPhHZ + oxyhaemoglobin	84TH03

Table 1 (*Continued*). DMPO Spin-Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other A's/G, [g-value], Source	Reference(s)
DMPOX	DMSO	7.0	3.5(2)	Fe-phthalocyanine + light	85BE01
DMPOX	W(5)	7.1	4.2(2)	chloramine-T or permanganate	85EV02
DMPOX	W(TR3.0)	7.1	4.2(2)	lignin model + ligninase	86HA01
2,2'-dimer	W(P7.4)	14.2	15.9	[2.0054] oxyhaemoglobin + hydrazine	84TH03
2,2'-dimer	W	14.18	15.86	[2.0054] chemical synthesis of dimer	84TH03
DMPO-degradation	W(P)	15.31	22.0	xanthine oxidase + xanthine, appears late	79FI01
Unidentified oxidation	W	14.05	13.35	DMPO + Fe(III) additional products observed	80SC01
$^{\cdot}N(OH)C(CH_3)_2CH_2CH_2C(=O)OH$	W(7)	14.3	16.2	A_N = 4.2, [2.0053] oxidation by $Co\text{-}O_2^{\cdot}$	82HI01
Nitroso product	CH_2Cl_2	15.50		trioxolane + DMPO	81PR02

*In Reference 84KA01 the values of A_N and A_H were inadvertently interchanged (J. Trudell and R. Mason, private communication, 1987. See also 87TR01).

**The hyperfine splittings for the $^{\cdot}OH$ and $^{\cdot}OOH$ adducts of 5-butyl-5-methyl-1-pyrroline 1-oxide, 5,5-dipropyl-1-pyrroline 1-oxide and 2-aza-2-cyclopentenespirocyclopentane 2-oxide are given in 86TU01. See also 86CA01 for an example of the use of the dipropyl analogue of DMPO.

†*Tert*-butoxyl spin adducts of alkyl substituted variations of DMPO are also presented in 82HA01.

Table 2. PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$H^{\cdot}$	Benzene	14.25	7.13	*p*-nitroperbenzoic acid and amine	69JA01
$H^{\cdot}$	Benzene	14.22	7.11	photolysis of $n\text{-}Bu_3SnH$	69JA01
$H^{\cdot}$	W	16.8	10.9(2)	radiolysis of water	76SA01
$H^{\cdot}$	W	16.7	10.6(2)	[2.0056] electrolysis of water	78KA01
$e^- + H^+$	W(P7.0)	16.2	10.5(2)	$NaBH_4$ reduction of PBN	78LO01
$H^{\cdot}$	Toluene	14.99	7.49	[2.0053] an alkylcobaloxime + light	78MA01
$e^- + H^+$ (reduction)	W	16.2	10.5(2)	sodium borohydride reduction, air oxidation	81LO01
$H^{\cdot}$	W	16.4	10.2(2)	TiO + light with $NaHCO_3$	82AU01
$H^{\cdot}$	W/EtOH 3:1	16.5	9.2(2)	chlorohemin + light	83MA02
$H^{\cdot}$	W(8.5)	15.50	8.75(2)	chloramine-*T* + light	85EV03
$H^{\cdot}$	W	16.57	10.50(2)	gamma radiolysis of water	86LA01
$D^{\cdot}$	Toluene	14.66	7.44	A_D = 1.25, [2.0070] alkycobaloximes + light	78MA01
$^{\cdot}CH_3$	Benzene	14.20	3.45	photolysis of dimethylmercury	69JA01, 68JA01
$^{\cdot}CH_3$	Benzene	14.15	3.41	organolithium and oxygen	68JA01
$^{\cdot}CH_3$	Benzene	14.24	3.45	CH_3HgCl + light	69JA01
$^{\cdot}CH_3$	Toluene	14.91	3.66	[2.0061] alkylcobaloximes + light	78MA01
Ethyl	Benzene	13.89–14.00	3.13–3.20	photolysis of organo-Pb, -Sn or -Hg	69JA01
Ethyl	W(C10.0)	16.2	3.4	Cu-catalyzed oxidation of ethyl hydrazine	81AU01
Ethyl	W(P7.5)	16.3	3.2	microsomes + ethyl hydrazine	81AU01
Ethyl	Benzene	14.3	3.3	Cu-catalyzed oxidation of ethylhydrazine	81AU01
Ethyl	Benzene	14.4	3.2	microsomes + ethylhydrazine	81AU01
$^{\cdot}CH(CH_3)_2$	Toluene	14.66	2.58	alkylcobaloximes + light	78MA01
$^{\cdot}CD(CD_3)_2$	Toluene	14.66	2.58	alkylcobaloximes + light	78MA01
n-Butyl	Benzene	13.73– 4.15	2.08–3.13	photolysis of organo-Pb, -Sn or -Hg	69JA01
n-Butyl	AcN	14.88	3.05	electrolysis of $TBABBu_4$	79BA01
n-Butyl	Benzene	14.6	3.4	tributyltin chromate + UV	81RE01
n-Butyl	CH_2Cl_2	14.6	3.3	tributyltin chromate + UV	81RE01
Cyclohexyl	Cyclohexane	14.5	2.2	gamma radiolysis of cyclohexane	77IW01
$^{\cdot}CH_2(CN)$	Toluene	14.41	3.58	[2.0065] alkylcobaloximes + light	78MA01
$^{\cdot}CH_2(CN)$	AcN	14.43	2.10	diazonium salt + ultrasound	84RE07
$^{\cdot}CH_2OH$	MeOH	15.31	3.73	*t*-butyl-O-O-*t*-butyl + UV	73LE01
$^{\cdot}CH_2OH$	MeOH and W	15.36	3.76	peroxydisulfate + UV	73LE01
$^{\cdot}CH_2OH$	MeOH	15.41	3.73	H_2O_2 + UV	73LE01
$^{\cdot}CH_2OH$	W/MeOH 2:1	15.79	3.78	*t*-butyl-O-O-*t*-butyl	73LE01
$^{\cdot}CH_2OH$	MeOH	15.3	3.75	gamma-irradiated MeOH	74MA01
$^{\cdot}CH_2OH$	MeOH	15.6	3.7	gamma-irradiated MeOH	75ZU01
$^{\cdot}CH_2OH$	W(TR7.4)	16.00	3.74	[2.0056] liver microsomes + NADPH + EtOH	77SA01
$^{\cdot}CH_2OH$	W(P)/MeOH 9:1	16.07	3.86	[2.0056] MeOH(10%) + 1% H_2O_2 + UV light	77SA01

Table 2 (*Continued*). PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$^{\cdot}CH_2OH$	MeOH	14.14	2.06	MeOH + H_2O_2 + UV light	77SA01
$^{\cdot}CH_2OH$ or TRIS$^{\cdot}$	W(TR7.4)/MeOH 19:1	16.2	3.60	H_2O_2 + MeOH + UV light in TRIS	77SA01
$^{\cdot}CH_2OH$	MeOH	15.3	3.8	Fe(III) + light in MeOH	79RE01
$^{\cdot}CH_2OH$	MeOH	15.40	3.77	photolysis of cobalt azido complex	79RE02
$^{\cdot}CH_2OH$	W	16.1	3.75	TiO + light with MeOH	82AU01
$^{\cdot}CH_2OH$	Toluene	15.0	6.6	[2.0058] Dry toluene, BP* + MeOH	82KO02
$^{\cdot}CH_2OH$	MeOH	15.1	3.6	[2.0058] BP*	82KO02
$^{\cdot}CH_2OH$	MeOH/Toluene		varies	variation of A_H shown versus [MeOH]	82KO02
$^{\cdot}CH_2OH$	MeOH	15.25	3.75	decay of tritiated MeOH	84HA01
$^{\cdot}CH_2CH_2OH$	Toluene	14.66	3.58	[2.0070] alkylcobaloximes + light	78MA01
$CH_3C^{\cdot}HOH$	EtOH	15.36	3.62	*t*-butyl-O-O-*t*-butyl	73LE01
$CH_3C^{\cdot}HOH$	W(TR7.4)	16.10	3.35	[2.0056] liver microsomes + NADPH + EtOH	77SA01
$CH_3C^{\cdot}HOH$	W(P)/EtOH 2:1	15.94	3.34	H_2O_2 + EtOH + UV light	77SA01
$CH_3C^{\cdot}HOH$	EtOH	15.4	3.6	Fe(III) + light in EtOH	79RE01
$CH_3C^{\cdot}HOH$	W(P7.4)	16.2	3.34	H_2O_2 + UV with EtOH	82FI01
$CH_3C^{\cdot}HOH$	W(P7.8)	16.1	3.3	[2.0057] EtOH + Fe(II)	82TE01
$CH_3C^{\cdot}HOH$	W/EtOH 3:2	15.5	3.7	chlorohemin + light	83MA02
PrOH radical	W(TR7.4)	16.10	3.23	liver microsomes + NADPH + propanol	77SA01
PrOH radical	W/PrOH 1:1	14.9	2.96	H_2O_2 + propanol + UV light	77SA01
PrOH radical	PrOH	14.9	2.96	H_2O_2 + UV light	77SA01
$^{\cdot}CH(OH)C_2H_5$	*n*-PrOH	15.3	3.6	Fe(III) + light in *n*-propanol	79RE01
$(CH_3)_2C^{\cdot}OH$	2-PrOH	15.48	3.60	peroxydisulfate	73LE01
$(CH_3)_2C^{\cdot}OH$	W(P7.8)	16.1	3.6	[2.0056] iso-PrOH + Fe(II)	82TE01
$(CH_3)_2C^{\cdot}CN$	THF	14.6	3.07	[2.0044] α, α′-azobisisobutronitrile	67IW01, 70IW01
$(CH_3)_2C^{\cdot}CN$	Xylene	13.4	3.7	dimethyl α, α′-azobisisobutyrate + heat	67IW01, 70IW01
$(CH_3)_2C^{\cdot}CN$?	Benzene	13.87	2.09*	azobisisobutyronitrile	77OH01
$(CH_3)_2C^{\cdot}CN$	Benzene	14.05	3.10	azobisisobutyronitrile	82BE01
$(CH_3)_2C^{\cdot}CN$	Benzene	14.29	3.28	E. G. Janzen, personal communication, 1987	
iso-Propyl radical	$CHCl_3$	14.9	2.49	hepatocytes + isopropylhydrazine	85AL01
iso-Propyl radical	$CHCl_3$	15.0	2.49	metal-oxidation of isopropylhydrazine	85AL01
$^{\cdot}CH(OH)C_2H_5$	*n*-BuOH	15.1	3.5	Fe(III) + light in *n*-BuOH	79RE01
$CH_3C^{\cdot}(OH)C_2H_5$	*sec*-BuOH	14.9	3.3	Fe(III) + light in *sec*-BuOH	79RE01
tert-BuOH radical	W(P)/*t*-BuOH 1:1	14.1	2.31	H_2O_2 + *tert*-butanol + UV light	77SA01
tert-BuOH radical	*t*-BuOH	14.1	1.8	H_2O_2 + UV light	77SA01
tert-BuOH radical	W(TR7.4)	16.03	3.62	liver microsomes + NADPH + *tert*-butanol	77SA01
$CH_3CH_2CH_2C^{\cdot}HOH$	*n*-BuOH/W 5:1	15.46	3.61	peroxydisulfate	73LE01
n-BuOH radical	W(TR7.4)	16.03	3.44	liver microsomes + NADPH + *n*-butanol	77SA01
TRIS radical	W(TR7.4)	16.00	3.75	microsomes + TRIS	77SA01
Acetone radical	W(TR7.4)	15.91	3.74	liver microsomes + NADPH + acetone	77SA01
Acetonitrile radical	W(TR7.4)	16.02	3.88	liver microsomes + NADPH + acetone	77SA01
DMSO "A"	W(TR7.4)	16.46	3.60	[2.0056] liver microsomes + NADPH + DMSO	77SA01
DMSO "B"	W(TR7.4)	15.10	3.42	[2.0058] liver microsomes + NADPH + DMSO	77SA01
DMSO radical	W(P)/DMSO 1:1	14.8	2.83	[2.0056] H_2O_2 + UV light	77SA01
DMSO radical	W(TR7.4)/DMSO 19:1	15.2	3.47	H_2O_2 + UV light	77SA01
DMSO radical	DMSO	13.9	2.31	[2.0056] H_2O_2 + UV light	77SA01
DMNA radical	W(TR7.4)	15.56	5.75	[2.0057] liver microsomes + NADPH + DMNA	77SA01
DMNA radical	W(P)/DMNA 9:1	15.68	5.66	[2.0057] H_2O_2 + UV light	77SA01
DENA radical	W(TR7.4)	15.56	4.70	[2.0057] liver microsomes + NADPH + DENA	77SA01
DENA radical	W(P)/DENA 9:1	15.68	4.50	[2.0057] H_2O_2 + UV light	77SA01
Acyl radical	2-MP	14.0	3.0	ozonation of 2-MP	83PR02
Acetyl	W(G10.0)	16.0	4.6	Cu-catalyzed oxidation of acetylhydrazine	81AU01
Acetyl	W(P7.5)	16.0	3.9	microsomes + acetylhydrazine	81AU01
Acetyl	Benzene	14.4	2.3	Cu-catalyzed oxidation of acetylhydrazine	81AU01
Acetyl	Benzene	14.0	2.2	microsomes + acetyl hydrazine	81AU01
Acetyl	CH_2Cl_2	14.2	3.4	ozone + dimethylacetylene, −30°C	82PR01
Acetyl?	C/M 2:1	14.4	3.12	hepatocytes + isoniazid, 213 K	83TO02
Acetyl?	$CHCl_3$	14.3	2.47	hepatocytes + acetylhydrazine	85AL01
Acetyl?	$CHCl_3$	14.4	2.53	metal-oxidation of acetylhydrazine	85AL01
Cyclohexadienyl	Benzene	14.4	2.0	cigarette smoke	85CH03, 84PR01
Cyclohexadienyl	Benzene	14.2	2.1	NO/isoprene/air	85CH03, 84PR01

Table 2 (*Continued*). PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
Alkyl radical	Benzene	14.4	3.2	cigarette smoke on solid PBN (on glass)	85CH03, 84PR01
Alkyl radical	Benzene	14.3	3.2	cigarette smoke on solid PBN (on silica)	85CH03, 84PR01
Alkyl radical	CCl_4	14.5	3.3	cigarette smoke	84PR01
SDS alkyl radical	Micelle	15.7	2.9	naphthoquinone photoreduction-SDS micelles	85OK01
amino acid radicals	W(M7.0)	16.3	5.0	Ce(IV) + nonsulfhydryl amino acids	83GR01
$^{\cdot}CN$	AcN	15.04	1.98	tetraethylammoniumCN, electrochemical	80JA02
$^{\cdot}CN$	Benzene	14.96	1.94	$C_6H_5CH_2CN$, $(CH_3)_3CN{=}O$, DBPO	80JA02
$^{\cdot}CN$	AcN	15.04	1.98	electrochemical oxidation of CN^- or SCN^-	82WA02
[^{13}C] $^{\cdot}CN$	AcN	15.02	2.03	A(13-C) = 9.85, electrochemical	84JA02
$^{\cdot}CN$	AcN	15.05	1.98	ICN + UV	85RE03
$^{\cdot}CONH_2$	W	15.53	3.20	A_N = 0.5, A_H = 0.5; $Hg(CN)_2$ + UV	85RE01
[^{13}C] $^{\cdot}CONH_2$	W	15.53	3.2	A_N = 0.5, A(13-C) = 10.49, $Hg(CN)_2$ + UV	85RE01
$^{\cdot}CONH_2$	AcN/W 6:1	14.85	0.82	A_N = 1.70, A(13-C) = 10.01; peroxydisulfate + CN + UV	85RE03
$CO_2^{\cdot-}$	W	15.9	4.6	TiO + light with formate	82AU01
$CO_2^{\cdot-}$	W(KHB7.6)	15.8	4.6	perfused liver	86CO01
$^{13}CO_2^{\cdot-}$	W(KHB7.6)	15.8	4.6	A(13-C) = 11.7; perfused liver	86CO01
$^{13}CO_2^{\cdot-}$	W	15.8	4.6	A(13-C) = 11.7; Fenton system + formate, pK_a = 2.85	86CO01
$^{\cdot}CF_3$	Benzene	13.30	1.54	A_F = 1.54, trifluoromethyl iodide	68JA01
$^{\cdot}CCl_3$	W(TR7.5)	14.1	1.8	[2.0059] CCl_4 or $BrCCl_3$ + liver microsomes	78PO01
$^{\cdot}CCl_3$	CCl_4	13.4	1.3	photolysis of $Fe(CO)_5$	79CA01
$^{\cdot}CCl_3$	C/M 2:1	not given		CCl_4 given in vivo, liver extract	79LA01
$^{13}CCl_3$	C/M 2:1	14.10	1.74	A(13-C) = 9.68, A(35-Cl) = 0.23, CCl_4 in vivo	80PO01
$^{\cdot}CCl_3$	CCl_4	14.	1.8	e^- irradiation, sample around 175K	80TO01
$^{\cdot}CCl_3$	C/M 2:1	14.	1.8	CCl_4 + microsomes or hepatocytes	80TO01
$^{\cdot}CCl_3$	$CHCl_3$	14.	1.75	hepatocytes + CCl_4	85CH01, 82AL01
$^{13}CCl_3$	$CHCl_3$	14.	1.75	A(13-C) = 9.7, hepatocytes + CCl_4	85CH01, 82AL01
$^{\cdot}CCl_3$	$CHCl_3$	14.	1.75	in vivo CCl_4 (rat)	82AL01
$^{13}CCl_3$	$CHCl_3$	14.	1.75	A(13-C) = 9.7, in vivo CCl_4 (rat),	82AL01
$^{\cdot}CCl_3$	30 different	14.06–15.73	1.77–3.57	photolysis of CCl_4 or $CBrCl_3$	82JA01
		A_H = 0.796A_N–9.40		for $^{\cdot}CCl_3$	82JA01
$^{\cdot}CCl_3$	W(TR7.5)	not given		microsomes + CCl_4 or $CBrCl_3$	82MC01
$^{13}CCl_3$	CCl_4	13.5	1.5	A(13-C) = 9.4, gamma irradiation of CCl_4	82SY01
$^{13}CCl_3$	W(P7.4)	13.9	1.5	A(13-C) = 9.5, A_{Cl} = 0.23(3), microsomes + CCL_4	84MC01
$^{\cdot}CCl_3$	C/M 2:1	14.0	1.75	hepatocytes + CCl_4	85AL02
$^{\cdot}CCl_3$	C/M 2:1	14.45	1.85	perfused liver and CCl_4	86CO01
$^{13}CCl_3$	C/M 2:1	14.45	1.85	A(13-C) = 9.20; perfused liver and $^{13}CCl_4$	86CO01
$^{\cdot}CCl_3$	Toluene	13.60	1.86	photolysis of $CBrCl_3$	86DA01
$^{\cdot}CCl_3$	W(7)	15.54	2.66	photolysis of $CBrCl_3$	86DA01
$^{\cdot}CCl_3$	CCl_4	14.0	1.5	x-ray radiolysis of CCl_4	87HA01
$^{\cdot}CHCl_2$	C/M 2:1	14.67	2.37	hepatocytes + $CHCl_3$	85AL02
$^{\cdot}CHCl_2$	C/M 2:1	14.66	2.37	hepatocytes + $CHBrCl_2$	85AL02
$^{\cdot}CHCl_2$ or $^{\cdot}CH_2Cl$	CH_2Cl_2	13.1	1.6	photolysis of alpha-phenylbenzoin	85BA01
$^{13}CHCl_2$	C/M 2:1	14.70	2.37	A(13-C) = 9.26, $^{13}CHCl_3$ + liver hepatocytes	85TO01
$^{\cdot}CHCl_2$	C/M 2:1	14.67	2.37	chloroform + hepatocytes (anoxic)	85TO01
$^{\cdot}CHCl_2$	Toluene	14.32	2.03	photolysis of $CHBrCl_2$ or $CHCl_3$	86DA01
$^{\cdot}CHCl_2$	W(7)	15.40	2.72	photolysis of $CHBrCl_2$ or $CHCl_3$	86DA01
$^{\cdot}CDCl_2$	C/M 2:1	14.70	2.37	deuterated chloroform + hepatocytes (anoxic)	85TO01
$^{\cdot}CHCl_2$	C/M 2:1	14.67	2.38	bromodichloromethane + hepatocytes (anoxic)	85TO01
$^{\cdot}CH_2Cl$	C/M 2:1	14.77	2.38	hepatocytes + CH_2Cl_2	85AL02
$^{\cdot}CH_2Cl$	Toluene	13.60	1.84	photolysis of CH_2Cl_2	86DA01
$^{\cdot}CHBr_2$	C/M 2:1	14.87	2.38	hepatocytes + $CHBr_3$	85AL02
$^{\cdot}CBr_3$	Toluene	13.52	1.76	photolysis of CBr_4	86DA01
$^{\cdot}CBr_3$	W(7)	15.44	2.64	photolysis of CBr_4	86DA01
$^{\cdot}CHBr_2$	C/M 2:1	14.87	2.38	bromoform + hepatocytes (anoxic)	85TO01
$^{\cdot}CH_2ClCH_2Cl$	C/M 2:1	14.05	3.01	hepatocytes + 1,2-dichloroethane	85AL02
$^{\cdot}CCl_2CH_3$	C/M 2:1	14.65	2.25	hepatocytes + 1,1,1-trichloroethane	85AL02

Table 2 (*Continued*). PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$^{\cdot}CHClCH_2Cl$	C/M 2:1	14.55	2.95	hepatocytes + 1,1,2-trichloroethane	85AL02
$H_3CBrH_2C^{\cdot}$ or $H_3CHC^{\cdot}Br$	C/M 2:1	14.5	2.15	A(13-C) = 9.2, 1,2 dibromoethane + hepatocytes	83TO03
$^{\cdot}CCl_2CCl_3$	Toluene	13.52	1.92	photolysis of hexachloroethane	86DA01
$^{\cdot}CHClCF_3$	MeOH	14.4	2.25	rat liver hepatocytes + halothane	83TO01
$CF_3C^{\cdot}HCl$	W?	14.5–15.0	2.5–3.0	rat liver lipid extract after halothane	84FU01
$^{\cdot}CHClCF_3$	Toluene	13.72	1.92	photolysis of $CF_3CHClBr$	86DA01
$^{\cdot}CHClCF_3$	W(7)	15.47	2.67	photolysis of $CF_3CHClBr$	86DA01
$^{\cdot}CHI_2$	C/M 2:1	14.95	1.90	A(X) = 8.0, iodoform + hepatocytes	85AL02, 85TO01
Halothane-C$^{\cdot}$	C/M 2:1	14.6	2.4–2.5	in vivo halothane from liver	81PO01
Unidentified radical	W(P7.4)	not given		halothane and microsome-cytochrome P-450	82FU01
Linolenate-C$^{\cdot}$	W	16.2	3.0	linolenate acid emulsion + Fe(II)	83AZ01
Linolenate-C$^{\cdot}$	W	15.8	2.8	linolenatic acid emulsion + gamma radiolysis	83AZ01
Methyl linoleate-C$^{\cdot}$	Benzene	15.03	2.83	ML + DBPO	84YA01
Lipid dienyl	W(TR7.5)	not given		microsomes + CCl_4 (see also 80PO01)	79KA02
L$^{\cdot}$	W	15.83	3.31	[2.005] chloroplasts + oxyfluorfen	84LA01
L$^{\cdot}$	W	15.83	3.31	[2.005] chloroplasts + diphenyl ethers	84LA01
L$^{\cdot}$	W(P7.4)	14.5	3.25	microsomes + CCl_4 + NADPH	84MC01
L$^{\cdot}$	W(P7.4)	14.4	3.25	microsomes + CCl_4 + NADPH	84MC01
L$^{\cdot}$	W(P7.5)	14.8	2.5	endothelial cells + menadione	84RO01
Lipid radical (C$^{\cdot}$)	C/M 2:1	14.64	3.92	in vivo radiation of brain then extracted	86LA01
Lipid radical (C$^{\cdot}$)	C/M 2:1	14.75	3.25	in vivo radiation of brain then extracted	86LA01
Lipid radical (C$^{\cdot}$)	C/M 2:1	14.97	4.01	in vivo radiation of spleen then extracted	86LA01
Membrane-C$^{\cdot}$	Hexane	14.4	3.3	3-methylindole + microsomes	84KU01
Carbon-centered	Hexane	14.4	3.2	lung extracts after 3-methylindole	86BR01, 85KU01
Carbon-centered	Hexane	14.4	3.2	microsomes + 3-methylindole	86BR01, 85KU01
Phenyl	Benzene	14.41	2.21	PAT	75JA01
Phenyl	Benzene	14.41	2.21	phenylazotriphenylmethane	77OH01
Phenyl radical	Benzene	13.71–13.83	2.08–2.14	photolysis of 15 different organo-Pb, -Sn, or -Hg compounds	69JA01
Phenyl radical	30 different	14.10–15.96	2.00–4.21	PAT	82JA01
		$A_H = 1.11A_N - 13.69$		for the phenyl radical ** (See also 82JA03)	82JA01
Phenyl	W(P7.4)	16.2	4.3	[2.0054] phenylhydrazine + erythrocytes	83HI01
Phenyl	Hexane	14.25	2.10	A(13-C on phenyls) = 7.38(2), PAT	84JA03
Phenyl	Toluene	14.39	2.17	A(13-C on phenyls) = 7.41(2), PAT	84JA03
Phenyl (ENDOR)	Benzene	+14.57	+2.16	A_H = 0.09(4), PAT at 290 K	84JA04
Phenyl	AcN	14.70	2.76	diazonium salts + ultrasound	84RE07
Phenyl	Benzene	14.38	2.25	decay of tritiated benzene	85HA01
4-Methyl-$C_6H_4^{\cdot}$	CH_2Cl_2	14.25	2.19	phenylbenzoin + 4-Me-$C_6H_4N_2BF_4$ + light	85BA01
4-*tert*-Butyl-$C_6H_4^{\cdot}$	CH_2Cl_2	14.40	2.50	phenylbenzoin + 4-*tert*-butyl-$C_6H_4N_2BF_4$ + light	85BA01
$^{\cdot}CH_2C_6H_5$	Benzene	13.88–13.91	2.31–2.44	photolysis of organo-Pb, -Sn or -Hg	69JA01
$^{\cdot}CH_2C_6H_5$	Toluene	14.41	2.83	[2.0047] alkylcobaloximes + light	78MA01
Tetralyl	Benzene	14.30	2.26	tetralin + *tert*-BuO$^{\cdot}$	77OH01
Cumyl	Benzene	14.25	2.19	cumene + *tert*-BuO$^{\cdot}$	77OH01
Benzoyl radical	30 different	14.17–14.83	4.14–4.76	benzaldehyde + *tert*-BuO$^{\cdot}$	82JA01
		$A_H = 0.655A_N - 4.79$		for the benzoyl radical	82JA01
Benzoyl	W(P7.8)	16.0	4.35	[2.0055] PBN + Fe(III)	82TE01
Benzoyl	Benzene	14.0	4.46	alpha-phenylbenzoin + light	85BA03
Benzoyl	CH_2Cl_2	14.1	4.47	alpha-phenylbenzoin + light	85BA03
Diphenyl ketyl	Benzene	14.1	2.13	alpha-phenylbenzoin + light	85BA03
4-Nitrophenyl	30 different	14.12–15.09	1.90–2.97	4-nitrophenylazotriphenylmethane	82JA01
				$A_H = 1.08A_N - 13.24$ for the 4-nitrophenyl radical	82JA01
$N_3^{\cdot}$	W	15.01	2.01	A_N = 2.01, $K_3[Co(CN)_5N_3]$ photolysis, $t_{1/2}$ = 20 s	79RE01
$N_3^{\cdot}$	W	14.9	2.1	A_N = 2.1, Fenton system with azide	80JA02
$N_3^{\cdot}$	W	14.91	2.25	A_N = 2.25, peroxydisulfate + azide	80JA02
$N_3^{\cdot}$	W	15.01	2.01	A_N = 2.01, $K_3[Co(CN)_5N_3]$ + UV	80JA02
$N_3^{\cdot}$	W	15.05	2.06	A_N = 2.06, e^- irradiation	80KE01
$N_3^{\cdot}$	W	15.2	2.1	A_N = 2.1, methylene blue + light with azide	82HA02

Table 2 (*Continued*). PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$N_3^{\cdot}$	AcN	14.06	1.89	A_N = 1.89, electrochemical oxidation of N_3^-	82WA02
$N_3^{\cdot}$	AcN	14.10	1.90	A_N = 1.90, diazonium salt + heat	84RE07
$N_3^{\cdot}$	W(P7.6)	15.25	2.35	A(14-N) = 2.0, catalase/H_2O_2 + azide	85KA01
$^{15}N_3^{\cdot}$	W(Ac5.0)	15.25	2.35	A(15-N) = 2.8, HRP/H_2O_2 + azide	85KA01
$N_3^{\cdot}$	W	14.97	2.10	A_N = 2.10, peroxydisulfate + azide + UV	85RE04
$^{\cdot}NH_2$	W	16.14	3.54	A_N = 1.23, A_H = 0.54(2); peroxydisulfate + N_3^- + UV	85RE05
$^{\cdot}NHNH_2$	$CHCl_3$	16.6	3.1	microsomes + hydrazine	85NO01
$^{\cdot}NCO$	W	15.91	3.21	A_N = 1.89, KOCN + peroxydisulfate	80JA02
$^{\cdot}NCO$	W	5.76	3.26	A_N = 1.81, KOCN + UV	80JA02
$^{\cdot}NCO$	AcN	15.09	3.15	A_N = 1.84, tetraethylammonium OCN, electrochemical	80JA02
$^{\cdot}NCO$	AcN	15.10	3.18	A_N = 1.85, diazonium salt + ultrasound	84RE07
$(SCN)_2^{\cdot-}$	AcN	14.44	1.09	A_N = 3.70, diazonium salt + UV	84RE07
Indole ($N^{\cdot}$)	Hexane	13.9	3.6†	A_N = 2.3, indoles + KO_2	83KU01
Indole($N^{\cdot}$)	Hexane	13.9	3.6	A_N = 2.3, microsomes + 3-methylindole	84KU01
Indole ($N^{\cdot}$)	Hexane	13.9	3.6	A_N = 2.3, microsomes + 3-methylindole	85KU01
$CH_3C_6H_4SO_2N^{\cdot}(H)$	W(5)	15.63	3.38	A_N = 1.75, chloramine-T in acid	85EV02
Above rearranged	W(5)	7.1		A_N = 4.2, chloramine-T in acid	85EV02
$CH_3C_6H_4SO_2N^{\cdot}(Na^+)$	W(8.5)	15.58	3.25	A_N = 1.63, chloramine-T + light	85EV03
$^{\cdot}OH$	W	15.3	2.75	[2.0057] H_2O_2 + UV light	74HA01
$^{\cdot}OH$	W	15.6	2.7	radiolysis of water	76SA01
$^{\cdot}OH$	W	15.5	2.75	[2.0061] H_2O_2 + UV light	77LA01
$^{\cdot}OH$	W(P7.4)	15.5	2.75	microsomes + NADPH	77LA01
$^{\cdot}OH$	Benzene	14.12	2.01	H_2O_2 + UV	78JA02
$^{\cdot}OH$	W	15.49	2.74	Fe(III)-ADP-H_2O_2	78JA02
$^{\cdot}OH$		A_H = 0.604A_N–6.53		summary of A's given	78JA02
$^{\cdot}OH$	W	20.2	28.9	[2.0045] electrolysis of water	78KA01
$^{\cdot}OH$	W(P7.4)	15.25	2.75	[2.0061] microsomes + NADPH	78LA01
$^{\cdot}OH$	W(P7.4)/DMSO 9:1	16.0	3.4	[2.0061] semiquinone of mitomycin + PBN	78LO01
$^{\cdot}OH$	W/DMSO 9:1	16.0	3.4	[2.0061] Fenton system	78LO01
$^{\cdot}OH$	W	15.3	not given	[2.0057] Fe(II)-Bleomycin	78SU01
$^{\cdot}OH$	W(6.9)	15.3	not given	[2.0057] BLM or Tallysomycin and Cu(I) or Fe(II)	79SU01
$^{\cdot}OH$	W	15.6	2.7	e^- irradiation	80KE01
$^{\cdot}OH$	W	15.3–15.6	2.6–2.7	Ti(III) + H_2O_2	80SC01
$^{\cdot}OH$	W	15.6	2.6	Fe(II)sulfate + H_2O_2	80SC01
$^{\cdot}OH$	W(6.9)	15.3	not given	[2.0057] Fe(II)-bleomycin + oxygen	80SU01
$^{\cdot}OH$	Ethyl acetate	–	2.1	Fenton system	81BÖ01
$^{\cdot}OH$	W	15.35	2.7	TiO + light	82AU01
$^{\cdot}OH$	W(P7.4)	15.3	2.75	H_2O_2 + UV or decomposition of PBN-OOH	82FI01
$^{\cdot}OH$	W(TR7.5)	16.2	3.38	quinone drugs + NADPH and cytochrome P-450	82KO01
$^{\cdot}OH$	W(TR9.1)	15.6	3.6	[2.0053] rifamycin SV	82KO05
$^{\cdot}OH$	W(P7.0)	not given		Fe(II)-BLM or Fenton system	82RO01
$^{\cdot}OH$	W(P7.8)	15.5	2.7	[2.0057] Fenton system	82TE01
$^{\cdot}OH$	W	15.46	2.72	$SO_4^{\cdot-}$ + $AsO_2^{\cdot}$	84RE01
"$^{\cdot}OH$"	W	15.46	2.72	hexachloroplatinate + light; Cl. and hydrolysis	84RE02
"$^{\cdot}OH$"	W	15.46	2.72	trans-[Co(1,2-diamino-etane)$_2$Cl$_2$]Cl + UV	84RE08
$^{\cdot}OH$	W(P7.5)	15.5	2.7	adriamycin + cytochrome P-450 reductase	84SU01
$^{\cdot}OH$	W(P7.5)	15.5	2.7	enzymatic reduction of quinoids	84TE01
$^{\cdot}OH$	W(P7.4)	16.0	3.2	[2.0063] Elliptinium acetate, H_2O_2, Fe	85DU01
$^{\cdot}OH$	W	15.49	2.75	$Hg(CN)_2$ + UV light	85RE01
$^{\cdot}OH$	W	15.53	2.72	H_2O_2 + UV	85RE03
$^{\cdot}OH$	W	15.98	3.12	gamma radiolysis of water	86LA01
"$^{\cdot}OH$"	W	15.5	2.72	persulfate + Ag(I)	86MO03
[^{17}O]"$^{\cdot}OH$"	W	15.5	2.72	A(17-O) = 3.36, persulfate + Ag(I)	86MO03
$^{\cdot}OH$	W(P7.0)	not given		Fenton system or Fe(II)BLM + H_2O_2	86RO01
$^{\cdot}OH$	Ethyl acetate	13.71	2.1	Fenton system	87TR01

Table 2 (*Continued*). PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
·OOH	W	14.8	2.75	[2.0057] H_2O_2 + UV light	74HA01
·OOH	Benzene	14.28	2.25	autoxidation of cyclohexa-1,4-diene	77OH01
·OOH	W	14.9	2.8	[2.0057] Fe(II)-bleomycin	78SU01
·OOH	W(TR7.4)	14.8	2.75	microsomes + mitomycin C	80KA01
·OOH	AcN	14.8	3.0	oxidizing ML + $FeCl_3$	80SC01
·OOH	W	15.0	3.2	Cumene hydroperoxide + Fe(II)sulfate	80SC01
·OOH	W(6.9)	14.9	2.8	[2.0057] Fe(II)-bleomycin + oxygen	80SU01
·OOH	Ethyl acetate	–	4.5	KO_2 or NADPH + cytochrome *P*-450 reductase	81BÖ01
·OOH	CH_2Cl_2	13.40	1.25	trioxolane, −60°C	81PR02
·OOH	W(P7.5)	14.8	2.89	enzymatic reduction of quinoids	84KU01
·OOH	W(P7.4)	14.81	2.7	microsomes/paraquat/NADPH	86MO03
[^{17}O] ·OOH	W(P7.4)	14.81	2.7	*A*(17-O) = 2.7, microsomes/paraquat/ NADPH/$^{17}O_2$	86MO03
·OOH	Ethyl acetate	14.90	4.28	KO_2	87TR01
CH_3O·	MeOH	14.37	2.86	paraquat + UV	73LE01
CH_3O·	MeOH and W	14.50	2.94	peroxydisulfate	73LE01
CH_3O·	W/MeOH 2:1	14.90	3.35	paraquat + UV	73LE01
CH_3O·	W/MeOH 2:1	14.93	3.32	peroxydisulfate	73LE01
CH_3O·	MeOH	14.5	2.80	gamma-irradiated MeOH	74MA01
CH_3O·	MeOH	14.3	2.95	gamma-irradiated MeOH	75ZU01
CH_3O·	MeOH	14.2	2.7	Ce(IV) + light	79RE01
CH_3O·	MeOH	14.5	2.8	decay of tritiated MeOH	84HA01
CH_3CH_2O·	EtOH and W	14.49	2.68	paraquat + UV	73LE01
CH_3CH_2O·	EtOH	14.4	2.6	Ce(IV) + light	79RE01
n-PrO·	*n*-PrOH	14.3	2.5	Ce(IV) + light	79RE01
2-PrO·	2-PrOH	14.60	2.20	paraquat + UV	73LE01
2-PrO·	2-PrOH	14.4	2.2	Ce(IV) + light	79RE01
n-BuO·	*n*-BuOH/W 5:1	14.40	2.42	paraquat + UV	73LE01
n-BuO·	AcN	13.80	2.27	electrolysis of $TBABBu_4$ with oxygen	79BA01
n-BuO·	*n*-BuOH	14.3	2.5	Ce(IV) + light	79RE01
n-BuO·	Benzene	13.6	2.0	tributyltin chromate	81RE01
n-BuO·	CH_2Cl_2	13.6	2.2	tributyltin chromate	81RE01
sec-BuO·	Benzene	13.94	1.91	[2.0062] lead tetraacetate + peroxide, RT	77ME01
sec-BuO·	*sec*-BuOH	14.4	2.2	Ce(IV) + light	79RE01
iso-BuO·	*iso*-BuOH	14.4	2.3	Ce(IV) + light	79RE01
tert-BuO·	Benzene	14.21	1.83	*tert*-BuOOC(O)C(O)OO-*tert*-BU	77OH01
tert-BuO·	Toluene	13.62	1.72	[2.0064] di-*tert*-butylketone + UV, 273 K	78HO01
tert-BuO· [^{17}O]	Toluene	13.62	1.72	*A*(17-O) = 5.05, di-*tert*-butylketone + UV, 298 K	78HO01
tert-BuO·	*tert*-BuOH	14.0	1.4	Ce(IV) + light	79RE01
tert-BuO·	Benzene	14.29	1.84	di-*tert*-butylperoxide	82HA01
tert-BuO·	Benzene	14.11	1.83	*tert*-BuOOC(O)C(O)OO-*tert*-Bu	83NI01
tert-BuO·	Benzene	14.48	1.86	*tert*-BuOOH + Co(II)	83NI01
tert-BuO·	Benzene	14.34	1.84	*tert*-$BuOCH_2Ph$ + *tert*-BuO· + MNP	83NI01
tert-BuO· (ENDOR)	Benzene	+14.48	+1.73	A_H = − 0.70(4), di-*tert*-butylperoxylate	84JA04
n-Pentyloxyl	Benzene	13.89	2.21	[2.0062] lead tetracetate + peroxide, RT	77ME01
n-Pentyloxyl	AcN	13.83	2.27	KO_2 + 1-bromopentane	79BA01
Tetralyloxyl	Benzene	14.18	2.28	tetralylOOH + Co(II)	83NI01
MLO·	AcN	14.8–15.3	2.0	oxidized ML + $FeCl_3$	80SC01
MLO·	ML	14.8	1.8–2.0	oxidizing ML + Fe(II)sulfate	80SC01
Cumene-O·	W	14.6	3.7	cumene hydroperoxide + $FeCl_3$	80SC01
Cumene-O·	W	14.4	3.4	cumene hydroperoxide + Fe(II)sulfate	80SC01
LO·	Freon-11	13.7	1.8	ozone + methyl linoleate, RT	81PR03
LO·	W(P7.4)	13.8	2.0	microsomes + CCl_4 + NADPH	84MC01
LO·	W(P7.4)	13.5	2.0	microsomes + CCl_4 + NADPH	84MC01
LO·	W(P7.4)	13.88	2.17	microsomes + CCl_4 + NADPH under oxygen	84MC01
LO·	Benzene	14.22	2.10	methyl linoleate hydroperoxide + Co(II)	84YA01
LO·	Folch	13.8	2.2	liver extract with AMOL in vivo	85MI02
LO·	W(P7.4)?	13.8	2.2	liver homogenate + MLOOH	85MI01
?	W(P7.4)	16.1	3.0	microsomes + MLOOH	85MI01
L·, LO· and/or LOO·	Freon-11	13.7	1.8	ozone + methyl linoleate, −40°C	81PR01
Alkoxyl radical	TME	13.5	1.8	ozonation of TME, 240 K	83PR02

Table 2 (*Continued*). PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
RO·	Benzene	13.76	1.99	cigarette, cigar or pipe smoke	71BL01
Alkoxyl radical	Benzene	13.6	1.9	cigarette smoke	85CH03, 84PR01
Alkoxyl radical	Benzene	13.8	1.9	cigarette smoke using solid PBN, glass	85CH03, 84PR01
Alkoxyl radical	Benzene	13.7	2.0	cigarette smoke using solid PBN, silica	85CH03, 84PR01
Alkoxyl radical	Benzene	13.8	2.1	NO/isoprene/air	85CH03, 84PR01
Alkoxyl radical	Benzene	13.7	2.0	NO_2/isoprene/air	85CH03, 84PR01
Alkoxyl radical	CCl_4	13.8	1.8	cigarette smoke	85CH03, 84PR01
Alkoxyl radical	Benzene	13.63	2.0	mainstream cigarette smoke	85HA02
Vinyl nitroxide?	Benzene	10.25		mainstream cigarette smoke	85HA02
Cigarette smoke	*t*-BB	13.4	1.8	sidestream cigarette smoke: an oxy radical	83PR01
Acetoxyl	CH_2Cl_2	13.4	1.4	ozone + dimethylacetylene, −70°C	82PR01
Acetoxyl	Benzene	12.84	1.73	lead tetraacetate + light	68JA01
Acetoxyl	Benzene	12.84–13.10	1.73–2.05	photolysis of organometallics	69JA01
Benzoyloxyl	Benzene	12.76	1.40	benzoyl peroxide	68JA01
Benzoyloxyl	Benzene	12.6–12.85	1.20–1.48	organometallic or peroxides	69JA01
Benzoyloxyl	Benzene	13.07	1.44	benzoyl peroxide	82BE01
Benzoyloxyl (ENDOR)	Benzene	13.22	1.41	A_H = 0.11(4), benzoyl peroxide	84JA04
Acyloxyl or peroxyl	TME	13.1	1.4	ozonation of TME	83PR02
PBN—O·	W	15.8	2.0	Ti(III) + H_2O_2	80SC01
PBN—O·	W	15.9	1.6–1.9	PBN + $FeCl_3$	80SC01
PBN—O·	AcN	15.7	2.0	Peroxidized methyl linoleate + $FeCl_3$	80SC01
sec-BuOO·	CH_2Cl_2	13.50	1.40	[2.0062] lead tetraacetate + peroxide, 193 K	77ME01
tert-BuOO·	CH_2Cl_2	13.39	1.19	[2.0062] lead tetraacetate + peroxide at 193 K	77ME01
tert-BuOO·	Benzene	13.40	1.57	autoxidation of *tert*-BuOOH	77OH01
tert-BuOO·	Benzene	13.34	1.25	*tert*-BuOOH + *tert*-BuO·	77OH01
tert-BuOO·	Toluene	12.65	0.95	[2.0064] di-*tert*-butylketone + UV, 213 K	78HO01
tert-BuOO·	Toluene	13.42	0.95	[2.0064] di-*tert*-butylketone + UV, 253–273 K	78HO01
tert-BuOO· [^{17}O]	Toluene	12.85	0.95	A(17-O) = 2.9, di-*tert*- butylketone + UV 213 K	78HO01
tert-BuOO·	Benzene	13.35	1.38	*tert*-BuOOH + *tert*-BuO·	83NI01
tert-BuOO·	Benzene	13.53	1.39	*tert*-BuOOH + Co(II)	83NI01
Cumyldioxyl	Benzene	13.55	1.82	autoxidation of cumylhydroperoxide	77OH01
Cumyldioxyl	Benzene	13.54	1.71	cumyl hydroperoxide + *tert*-BuO·	77OH01
Tetralyldioxyl	Benzene	13.66	1.84	autoxidation	77OH01
Tetralyldioxyl	Benzene	13.68	1.84	tetralyl hydroperoxide + *tert*-BuO·	77OH01
Tetralyldioxyl	Benzene	13.79	1.98	tetralyl hydroperoxide + Co(II)	83NI01
Tetralyldioxyl	Benzene	13.96	1.94	tetralyl hydroperoxide + *tert*-BuO·	83NI01
Tetralyldioxyl	Benzene	13.86	1.83	tetralyl hydroperoxide + lead tetraacetate	83NI01
Tetralyldioxyl	Benzene	13.81	1.88	tetralin + *tert*-BuO· + O_2	83NI01
α-Methylbenzyl-dioxyl	Benzene	13.57	1.78	autoxidation	77OH01
α-Methylbenzyl-dioxyl	Benzene	13.54	1.82	photolysis of azobis-α-phenylethane under O_2	77OH01
MLOO·	ML	14.4	2.2	oxidizing ML + $FeCl_3$	80SC01
MLOO·	Benzene	13.44	1.63	methyl linoleate hydroperoxide + *tert*-BuO·	84YA01
n-$C_5H_{11}OO$·	CH_2Cl_2	13.44	1.39	[2.0062] lead tetraacetate + peroxide, 193 K	77ME01
$C_6H_5C(CH_3)_2OO$·	CH_2Cl_2	13.46	1.47	[2.0062] lead tetraacetate + peroxide, 193 K	77ME01
$C_{18}H_{37}OO$·	CH_2Cl_2	13.50	1.61	[2.0062] lead tetraacetate + peroxide, RT	77ME01
n-$C_{18}H_{37}OO$·	Benzene	13.86	2.18	[2.0062] lead tetraacetate + peroxide RT	77ME01
CCl_3OO·	CCl_4	13.5	1.6	gamma-irradiation	85CH01, 82SY01
CCl_3OO·	CCl_4	13	1.63	e^- irradiation of CCl_4, about 175 K	80TO01
Oxy-Centered	Hexane	13.7	2.0	derived from phosphate buffer	84KU01
$\cdot OPO_3^{2-}$	W	15.46	1.84		85RE05
$\cdot PO_3^{2-}$	W	15.87	3.13	A(31-P) = 21.66, A_H = 0.2(2)	85RE05
$\cdot HPO_2^-$	W	16.08	3.17	A(31-P) = 16.03, A_H = 1.84, 0.27(2)	85RE05
$\cdot OSO_3^-$	AcN	13.90	1.23		85RE05
$\cdot OSO_3^-$	AcN/W 6:1	13.90	1.23	peroxydisulfate photolysis	85RE03

Table 2 (*Continued*). PBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$SO_3^{\cdot-}$	W	14.95	1.97	A_H = 0.34(2)	85RE05
$AsO_4^{\cdot-}$ oxy-centered	W	15.46	2.72	A(As, I = 3/2) = 0.96, $S_2O_8^{2-}$ + Na_2HAsO_4 and light	84RE01
Cysteinyl	W(M7.0)	15.7	3.4	$t_{1/2}$ = 5 min, Ce(IV) + cysteine	83GR01
p-$ClC_6H_4S^{\cdot}$	Benzene	13.8	1.8	$t_{1/2}$ = 0.38s, photolysis of the disulfide	84IT01
p-$CH_3OC_6H_4S^{\cdot}$	Benzene	13.9	1.8	$t_{1/2}$ = 0.15s, photolysis of the disulfide	84IT01
$CH_3C_6H_4S^{\cdot}O_2$	W(8.5)	14.75	2.25	chloramine-T + light	85EV03
$F^{\cdot}$	Benzene	12.2	1.18	A(19-F) = 45.6	85RE05
$Cl^{\cdot}$	AcN	12.27	0.82	A(Cl-35,37) = 6.20, 5.12; electrochemical	80JA02
$Cl^{\cdot}$	Benzene	12.12	0.75	A(Cl-35,37) = 6.05, 4.88; electrochemical	80JA02
$Cl^{\cdot}$	CCl_4	12.22	0.8	A(Cl-35,37) = 6.08, 5.0; electrochemical	80JA02
$Cl^{\cdot}$	CCl_4	12.2	0.7	A(35-Cl) = 6.1, radiolysis of CCl_4	85CH01, 82SY01
$Cl^{\cdot}$	AcN	12.70	0.82	A(Cl-35,37) = 6.20, 5.12; electrochemical	82WA02
$Cl^{\cdot}$	AcN	12.70	0.89	A(Cl-35,37) = 6.20, 5.12, hexachloroplatinate	84RE02
$Cl^{\cdot}$	AcN	12.70	0.82	A(Cl-35,37) = 6.20, 5.12	85RE05
$Cl^{\cdot}$	Toluene	12.32	0.70	A(Cl-35,37) = 6.16, 5.17, photolysis of CCl_4, $CBrCl_3$, C_2Cl_6	86DA01
$Cl^{\cdot}$	CCl_4	12.25	0.75	A(Cl-35,37) = 6.25, 5.2; CCl_4 x-ray radiolysis	87HA01
$Br^{\cdot}$	Benzene	11.3		A(Br-79,81) = 32.4, 34.9; bromine + light, $t_{1/2}$ < 2s	84RE10
Unidentified	W	16.1	2.7	Fe(II)sulfate + H_2O_2	80SC01
Unidentified	W	15.9	3.7	Fe(II)sulfate, ascorbate, EDTA, H_2O_2	80SC01
Unidentified	W	15.9	3.7	cumene hydroperoxide + Ti(III)-citrate	80SC01
Unidentified	W	16.5	3.6	PBN + Fe(II)sulfate	80SC01
Unidentified	AcN	14.5–15.0	2.7–2.9	oxidized ML + Fe(II)sulfate	80SC01
Unidentified	W	17.1	14.0	cumene hydroperoxide + Fe(II)sulfate	80SC01
PBN$^{\cdot}$	W	16.2	3.5	cumene hydroperoxide + Ti(III)-citrate	80SC01
PBN$^{\cdot}$	W	16.1	3.7	cumene hydroperoxide + $FeCl_3$	80SC01
PBN$^{\cdot}$	W	16.0–16.3	3.7	cumene hydroperoxide + Fe(II)sulfate	80SC01
PBNOx	CH_2Cl_2	8.0		ozone + dimethylacetylene, −30°C	82PR01
PBNOx	CCl_4	7.95		CCl_4 x-ray radiolysis	87HA01
tert-butyl aminoxyl	W	14.58	13.90	degradation of PBN by $SO_4^{\cdot-}$ + AsO_2^-	84RE01

*This adduct is thought to be an oxygen-centered radical (E. G. Janzen, personal communication, 1987).
**Reference 82JA03 also shows the variation in A_N and A_H for eight different solvents as well as A(15-N) and A(13-C). In addition the temperature dependence of the hyperfine splittings are investigated.
†The values of A_H and A_N were inadvertently interchanged in 83KU01 (E. G. Janzen, personal communication, 1987).

Table 3*. MNP Spin Adduct Parameters (Also referred to as *t*-NB and NtB)†

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$H^{\cdot}$ (e^- + H^+)	W	14.4	14.4	radiolysis of water	76SA01
e^- + H^+	W	14.34	13.85	proflavin + 440 nm light	78LI01
e^- + H^+	W(TR7.5)	14.4	14.4	$NaBH_4$ reduction or microsomes	79KA01
$H^{\cdot}$	W(4.0)	14.55	13.95	sulfanilamide + UV	80CH03
$H^{\cdot}$ (reduction + H^+)	W(>4.5)	14.55	14.0	[2.0059] methionine + $^{\cdot}OH$	83DA01
$H^{\cdot}$	W	14.7	14.2	porphyrin photosensitization (occasionally)	84MO01
e^- + H^+ (reduction)	W(HEPES7.4)	14.4	14.4	reduction of MNP by mitochondria	86KE01
e^- + H^+ (reduction)	W(P7.8)	14.4	14.4	reduction of MNP by RSVM + *AA*	86SC02
e^- + H^+	W(P7.6)	14.6	14.4	reduction by HRP/styrene/H_2O_2/GSH	86ST01
e^- + D^+	D_2O	14.34		A_D = 2.1, proflavin + 440 nm light	78LI01
e^- + D^+	D_2O	14.0		A_D = 2.2, $NaBH_4$ reduction	79KA01
$^{\cdot}CH_3$	Benzene	15.25	11.3(3)	diacyl peroxide	70PE01
$^{\cdot}CH_3$	W(TR9.0)	16.2	13.3(3)	cumene hydroperoxide + metmyoglobin	78GR01

Table 3* (*Continued*). MNP Spin Adduct Parameters (Also referred to as *t*-NB and NtB)†

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$^{\cdot}CH_3$	W(11.5)	17.3	14.2(3)	gamma radiolysis of MNP	80MA05,79MA02
$^{\cdot}CH_3$	W	17.20	14.20(3)	CPZ or H_2O_2 + DMSO and UV light	82LI03
$^{\cdot}CH_3$	W(P7.8)	17.0	14.25(3)	[2.0055] adriamycin semiquinone + *t*-BuOOH	84KA01
$^{\cdot}CH_3$	W(B10)	17.8	14.5(3)	procarazine + HRP	84SI02
$^{\cdot}CH_3$	W(7.1)	17.2	14.5(3)	[2.0055] photodecomposition of bleomycin	85AN01
$^{\cdot}CH_3$	W	17.1	14.2(3)	220 nm UV on acetic acid	85CA01
$^{\cdot}CH_3$	W(HEPES7.4)	17.3	14.3(3)	*tert*-BuOOH and mitochondria	86KE01
$^{\cdot}CH_2CH_3$	Benzene	15.25	10.4(2)	diacyl peroxide	70PE01
$^{\cdot}CH(CH_3)_2$	W(P7.4)	16.6	2.0	iproniazid + PGS	83SI01
n-Bu$^{\cdot}$	CH_2Cl_2	15.2	9.9(2)	tributyl tin chromate + UV	81RE01
n-Bu$^{\cdot}$	Benzene	15.1	10.0(2)	tributyl tin chromate + UV	81RE01
$^{\cdot}C(CH_3)_3$ (i.e. *tert*-butyl)—see also DTBN					
tert-Butyl	W(11.5)	17.2		gamma radiolysis of MNP	80MA05,79MA02
tert-Butyl	Benzene	15.0		MNP + *tert*-BuO$^{\cdot}$	80NI01
tert-Butyl	CH_2Cl_2	15.84		trioxolane + PBN, −30°C	81PR02
$CH_3(CH_2)_8{}^{\cdot}$	Benzene	15.0	9.9(2)	A_H = 0.6(2), diacyl peroxide	70PE01
N-succinimidyl-$CH_2{}^{\cdot}$	Benzene	14.6	11.2(2)	A_N = 1.4, diacyl peroxide	70PE01
$^{\cdot}CH_2OH$	MeOH/W	15.2	5.45(2)	proflavin + 440 nm light	78LI01
$^{\cdot}CH_2OH$	MeOH	14.2	4.8(2)	di-*tert*-butylperoxyoxalate	70PE01
$^{\cdot}CH_2OH$	W(P7.4)	15.3	6.4(2)	Fenton system with MeOH	79LA03
$^{\cdot}CH_2OH$	W/MeOH 1:1	15.0	10.5(2)	[2.0055] photodecomposition of bleomycin	85AN01
$^{\cdot}CH_2OH$	W(P7.8)	15.4	6.25(2)	15-HPETE + RSVM + MeOH	86SC01
$CH_3C^{\cdot}HOH$	EtOH	14.5	2.3	di-*tert*-butylperoxyoxalate	70PE01
$CH_3C^{\cdot}HOH$	W(P7.4)	15.5	1.8	Fenton system with EtOH	79LA03
$CH_3C^{\cdot}HOH$	EtOH/W	15.2	2.06	proflavin + 440 nm light	78LI01
$CH_3C^{\cdot}HOH$	W(Ac4.6)	16.1	2.12	indole-3-acetic acid + HRP + EtOH	86MO04
$^{\cdot}CH_2CH_2OH$	W(9.1)	16.6	13.1(2)	A_H = 0.5(2), 2-chloroEtOH + porphyrin + light	84MO01
$CH_3CH_2C^{\cdot}HOH$	*n*-PrOH	14.1	1.8	di-*tert*-butylperoxyoxalate	70PE01
$^{\cdot}CHO$	CH_2Cl_2	7.0	1.4	dichromate + UV	82RE01
$^{\cdot}C(O)CH_3$	MeOH	7.8		phenyl acetate or acetonilide + UV	82RO05
$^{\cdot}C(O)CH_3$	AcN	7.9		phenyl acetate + UV	82RO05
$^{\cdot}C(O)CH_3$	Benzene	7.8		phenyl acetate + UV	82RO05
$^{\cdot}C(O)CH_3$	Dioxane	8.0		phenyl acetate + UV	82RO05
$^{\cdot}CH_2Cl$	W	16.2	8.5(2)	dye + light and monochloroacetic acid	85CA01
$^{\cdot}CHCl_2$	$CHCl_3$	12.2		A(Cl-35,37) = 3.3, 2.7; dichromate + UV	82RE01
$^{\cdot}CCl_3$	$CHCl_3$	12.5		A_{Cl} = 2.2(3), di-*tert*-butylperoxy-oxalate	70PE01
$^{\cdot}CCl_3$	CCl_4	13.1		A(35-Cl) = 2.25(3), photolysis of CCl_4	85CH01,82SY01
$^{\cdot}CCl_3$	Toluene	12.56		$A(^{35}Cl)$ = 2.40, photolysis of $CBrCl_3$	86DA01
$^{\cdot}COCl$	CCl_4	6.75		A(13-C) = 5.7, A(35-Cl) = 0.6; CCl_4 + UV	85CH01,82SY01
$^{\cdot}COCl$	$CHCl_3$	6.7		dichromate + UV	82RE01
$^{\cdot}CH_2$—COO^-	W(9.1)	16.0	8.5(2)	Gly + porphyrin + light	84MO01
$^{\cdot}CH_2$—COO^-	W	16.0	8.6(2)	dye photosensitization with malonic acid	85CA01
$^{\cdot}CH_2CH_2$—COO^-	W	16.8	12.2(2)	A_H = 0.65(2), dye, light and succinic acid	85CA01
Acyl radical	CH_2Cl_2	7.85		trioxolane + PBN, −60°C	81PR02
Acyl radical	2-MP	7.7		ozonation of 2-MP	83PR02
$^{\cdot}CH_2CH_2OH$	W	16.6	13.1(2)	A_H = 0.5(2), 2-chloroethanol + porphyrin + light	84MO01
$^{\cdot}CH_2$—COO^-	W	16.0	8.5(2)	Gly + porphyrin + light	84MO01
$^{\cdot}CH_2CH_2CH_2$—COO^-	W	16.7	12.1(2)	A_H = 0.65(2), dye light and glutaric acid	85CA01
$^{\cdot}CH_2CH_2CH_2COO^-$	W	16.7	10.3(2)	A_H = 0.60(2), dye + light and sebacic acid	85CA01
$^{\cdot}CH_2(CH_2)_3$—COO^-	W	16.8	11.7(2)	dye photosensitization with adipic acid	85CA01
$^{\cdot}CH_2C(OH)(COOH)CH_2COO^-$	W	16.1	11.7(2)	dye photosensitization with citric acid	85CA01
$^{\cdot}CH(OH)(CH(OH))COO^-$	W	15.0	1.9	A_H = 0.60, dye + light and tartaric acid	85CA01
$^{\cdot}CH(OH)CH_2COO^-$	W	15.6	1.8	dye + light and malic acid	85CA01

Table 3* (*Continued*). MNP Spin Adduct Parameters (Also referred to as *t*-NB and NtB)†

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$^{\cdot}CH_2CH(OH)COO^-$	W	16.3	11.7(2)	A_H = 0.75, dye + light and malic acid	85CA01
$^{\cdot}CH_2(CH_2)_2COOH$	$CHCl_3$	15.1	9.9(2)	A_H = 0.5(2), decomposition of $(HO_2C(CH_2)_3COO)_2$	79GA01
$CH_3SCH_2CH_2C^{\cdot}H(NH_3^+)$	W(2.5–4.5)	14.55	1.45	A_N = 2.90, A_H = 0.35(2), methionine + $^{\cdot}OH$	83DA01
$CH_3SCH_2CH_2C^{\cdot}H(NH_2)$	W(>4.5)	16.0	1.4	A_N = 1.4, A_H = 0.65(2), methionine + $^{\cdot}OH$	83DA01
$^{\cdot}CH_2CH(NH_3^+)—COO^-$	W(P5.0)	16.3	16.7,10.9	A_H = 0.45; cysteine sulfinic acid + HRP/H_2O_2	84HA02
$^{\cdot}CH_2CH(NH_3^+)COO^-$	W(P7.5)	15.9	16.1	A_H = 10.5, cysteinyl dopa + UV	86PI02
$^{\cdot}CH_2CH(NH_3)COO^-$	W	16.3	13.70(2)	DL-alpha-alanine + CPZ and UV light	82LI03
$^{\cdot}CH_2C(CH_3)_2N(OH)N{=}O$	W(11.5)	16.2	10.1(2)	gamma-radiolysis of MNP	80MA05,79MA02
$^{\cdot}CH_2C(CH_3)_2N(OH)N{=}O$	W(4.5)	16.2	11.4(2)	gamma-radiolysis of MNP	80MA05,79MA02
$^{\cdot}CH_2C(CH_3)_2N{=}O$ or $^{\cdot}CH_2C(CH_3)_2N(O){=}N(O)—t$-Bu	W(11.5)	16.6	11.1(2)	gamma-radiolysis of MNP	80MA05,79MA02
Indole-3-$C^{\cdot}H_2$	W(Ac4.6)	17.1	10.9(2)	indole-3-acetic acid + HRP + H_2O_2	86MO04
Indole-3-$C^{\cdot}D_2$	W(Ac4.6)	17.1		A_D = 0.6(2), indole-3-acetic acid + HRP + H_2O_2	86MO04
Phenyl	Benzene	12.3	1.97(3)	A_H = 0.87(2); benzoyl peroxide	78ZU01
Phenyl	Benzene	12.45	1.80(3)	A_H = 0.87(2); benzoyl peroxide	82BE01
$C_6H_5CH_2^{\cdot}$	Toluene	14.25	7.25(2)	di-*tert*-butylperoxyoxalate	70PE01
Benzyl	Benzene	15.0	7.5(2)	toluene + *tert*-BuO$^{\cdot}$	80NI01
Benzyl	W	16.63	10.56	1,3-diphenyl-3-propane + UV	85RO05
Benzyl	MeOH	15.80	8.50	1,3-diphenyl-3-propane + UV	85RO05
Benzyl	AcN	15.23	8.53	1,3-diphenyl-3-propane + UV	85RO05
Benzyl	Benzene	15.00	7.50	1,3-diphenyl-3-propane + UV	85RO05
α-Hydoxybenzyl§	W(TAR3.0)	15.4	2.6	A(13-C) = 4.5, DMHB + ligninase	85HA03
$C_6H_5C^{\cdot}(OH)(CH_3)_2$	W(TAR3.0)	15.6	2.1	A(13-C) = 4.5, DMHB + ligninase	85HA03
α-Phenylethyl	Benzene	14.8	3.8	ethylbenzene + *tert*-BuO$^{\cdot}$	80NI01
Styrene ($^{\cdot}$C-7)	W(P7.6)	16.	3.7	styrene/HRP/GSH/H_2O_2	86ST01
Styrene ($^{\cdot}$C-7)	W(P7.6)	16.		A_D = 0.6, deuterated styrene/HRP/GSH/H_2O_2	86ST01
Cumyl	Benzene	15.5		cumene + *tert*-BuO$^{\cdot}$	80NI01
Benzoyl	MeOH	8.1		phenylbenzoate + UV	82RO05
Benzoyl	AcN	8.1		phenylbenzoate + UV	82RO05
Benzoyl	Benzene	8.0		phenylbenzoate + UV	82RO05
Benzoyl	Dioxane	8.0		phenylbenzoate + UV	82RO05
$C_6H_5C(CH_3)_2C^{\cdot}H_2$	Benzene	15.0	8.65(2)	*tert*-butylbenzene + *tert*-BuO$^{\cdot}$	80NI01
$^{\cdot}CH_2C_6H_4NO_2$	W(TR7.4)	17.1	14.4(2)	*o*-nitrobenzyl + microsomal protein	86MO01
$^{\cdot}CH_2C_6H_4NO_2$	W(TR7.4)	16.5	10.6(2)	*p*-nitrobenzyl + microsomal protein	86MO01
$^{\cdot}CH_2C_6H_4SO_2N(Cl)Na$	W(8.5,11)	16.75	10.38(2)	chloramine-T + light	85EV03
$RC_6H_4C^{\cdot}H_2$	W(B10)	15.5	6.0(2)	procarbazine + HRP	84SI02
P$^{\cdot}$, promazyl	W(3.5–6.5)	14.1	1.99(2)	A_H = 0.92(1); CPZ + 330 nm light	85CH02
P$^{\cdot}$, promazyl	W(4.0)	14.1	1.99	A_H = 1.95, 0.95; CPZ + UV light	85MO01
$C_6H_5N(CH_3)C^{\cdot}H_2$	Benzene	14.4	7.6(2)	A_N = 3.1, benzoyl peroxide + dimethyl aniline	75SA01
$C_6H_5CO_2CH_2C^{\cdot}H(C_6H_5)$	Styrene	14.5	3.1	benzoyl peroxide + dimethyl aniline	75SA01
$CH_3(CH_2)_9CH_2^{\cdot}$	Benzene	14.8	10.0	lauroylperoxide + dimethyl aniline	75SA01
$C_6H_5N(C_2H_5)C^{\cdot}HCH_3$	Benzene	14.4	4.8	A_N = 4.8, benzoyl peroxide and N,N-diethylaniline	75SA01
$^{\cdot}C_6H_4SO_2NH_2$	W(4.0)	13.81	1.95(2)	A_H = 0.96(2), sulfanilamide + UV	80CH03
$^{\cdot}C_6H_4COOH$	W(4.0)	13.65	1.95(2)	A_H = 0.97(2), 4-aminobenzoic acid + UV	80CH01
$^{\cdot}C_6H_4NO_2$	W(4.0)	12.73	2.11(2), 1.01(2)	A_N = 0.48, 4-nitrobenzenesulfonamide + UV	80CH03
Uracilyl at C5	W(10–12)	16.30		gamma irradiation of 5-bromouracil	82HE01
Uracilyl at C5	W(P7.0)	15.70	2.4	air-free, adriamycin + light	85CA02
Uracilyl at C5	W(P7.0)	15.2	2.3	adriamycin + light	85CA02
Uracilyl at C6	W(P7.0)	15.1	0.8	A_N = 3.5, adriamycin + light	85CA02
Uracilyl at C6	W(P7.0)	15.2	1.5	A_N = 3.4, adriamycin + light	85CA02
1,3-Dimethyl uracil C6	W(P7.0)	15.0	2.15	A_N = 2.15, adriamycin + light	85CA02
Cytosine at C5	W(P7.0)	15.75	2.8	adriamycin + light	85CA02
Thymine at C5	W(P7.0)	16.70		adriamycin + light	85CA02
Thymine at N1 or N3	W(P7.0)	15.15		A_N = 3.40, adriamycin + light	85CA02
Uridinyl at N1	W(P7.0)	14.3		A_N = 3.0, radiolysis of uridine-5'-monophosphate	76KO01

Table 3* (*Continued*). MNP Spin Adduct Parameters (Also referred to as *t*-NB and NtB)†

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
Uridinyl-5'-monophosphate (˙C6)	W(P7.0)	14.9	4.8	A_H = 1.6, radiolysis of uridine-5'-monophosphate	76KO01
NH—C(=O)—NH—C(=O)—C˙H	W(9.5)	15.3	3.0	hydantin + gamma radiation	83MA03
N=C(—O⁻)—N=C(OH)—C˙H	W(11.9)	15.2	3.0,0.9	hydantin + gamma radiation	83MA03
Gly-Gly˙ (—COOH)‡	D_2O	16.15	9.9(2)	A_N = 2.7, 210–230 nm UV	80LI01
Gly-Gly˙ (—COOH)‡	W	16.2	9.9(2)	A_N = 2.70, dye photosensitization	85CA01
Ala-Gly˙ (—COOH)‡	W(P7.0)	16.05	9.90	A_N = 2.70, adriamycin + light	85CA02
Ala-Gly˙ (—COOH)‡	W/DMSO 4:1	16.0	9.8(2)	A_N = 2.75, photolysis of aminoquinone drugs	85CA03
Gly-Gly-Gly˙ (—COOH)‡	W	16.2	9.19(2)	A_N = 2.70, dye photosensitization	85CA01
Gly-Glu˙ (—COOH)‡	D_2O	15.7	1.7	A_N = 2.4, 210–230 nm UV	80LI01
Gly-Asp˙ (—COOH)‡	D_2O	15.6	1.8	A_N = 2.6, 210–230 nm UV	80LI01
Ala-Asp˙ (—COOH)‡	W	15.6	1.70	A_N = 2.80, dye photosensitization	85CA01
Gly-Ile˙ (—COOH)‡	D_2O	15.8	1.0	A_N = 2.8, 210–230 nm UV	80LI01
Gly-Ala˙ (—COOH)‡	D_2O	16.0	2.18	A_N = 2.18, 210–230 nm UV	80LI01
Gly-Ala˙ (—COOH)‡	W	16.0	2.16	A_N = 2.18, dye photosensitization	85CA01
Gly-Ala˙ (—COOH)‡	W(P7.0)	15.95	2.15	A_N = 2.15, adriamycin + light	85CA02
Ala-Ala˙ (—COOH)‡	W/DMSO 4:1	15.9	2.2	A_N = 2.2, photolysis of aminoquinone drugs	85CA03
Asp-Ala˙ (—COOH)‡	W(P7.0)	15.95	2.15	A_N = 2.15, adriamycin + light	85CA02
Asp-Ala˙ (—COOH)‡	W/DMSO 4:1	15.9	2.2	A_N = 2.2, photolysis of aminoquinone drugs	85CA03
Glu-Ala˙ (—COOH)‡	W	16.0	2.20	A_N = 2.20, dye photosensitization	85CA01
Asp-Ala˙ (—COOH)‡	W	16.0	2.20	A_N = 2.20, dye photosensitization	85CA01
Gly-Gly-Ala˙ (—COOH)‡	W(P7.0)	16.00	2.20	A_N = 2.20, adriamycin + light	85CA02
Gly-Val˙ (—COOH)‡	W	15.8	1.00	A_N = 2.45, dye photosensitization	85CA01
Gly-Val˙ (—COOH)‡	W(P7.0)	15.75	1.10	A_N = 2.80, adriamycin + light	85CA02
Gly-Val˙ (—COOH)‡	W/DMSO 4:1	15.6	1.2	A_N = 2.9, photolysis of aminoquinone drugs	85CA03
Gly-Gly-Val˙ (—COOH)‡	W(P7.0)	15.75	1.10	A_N = 2.80, adriamycin + light	85CA02
Ala-His˙ (—COOH)‡	W	15.6	1.26	A_N = 2.70, dye photosensitization	85CA01
Ala-His˙ (—COOH)‡	W(P7.0)	15.60	1.26	A_N = 2.70, adriamycin + light	85CA02
Gly-Tyr˙ (—COOH)‡	W	15.7	1.25	A_N = 2.70, dye photosensitization	85CA01
Gly-Tyr˙ (—COOH)‡	W(P7.0)	15.70	1.25	A_N = 2.70, adriamycin + light	85CA02
Ala-Ser˙ (—COOH)‡	W	15.6	1.58	A_N = 2.75, dye photosensitization	85CA01
Ala-Ser˙ (—COOH)‡	W(P7.0)	15.60	1.58	A_N = 2.75, adriamycin + light	85CA02
Ala-Thr˙ (—COOH)‡	W	15.6	1.26	A_N = 2.80, dye photosensitization	85CA01
Gly-Gly-Arg˙ (—COOH)‡	W(P7.0)	15.70	1.70	A_N = 2.75, adriamycin + light	85CA02
Phe-Asp-Ala-Ser-Val˙ (—COOH)‡	W(P7.0)	15.75		A_N = 2.80, adriamycin + light	85CA02
Lipid radical or $CCl_3OO˙$	W(TR7.4)	15.0		CCl_4 and microsomes	78IN01
Allylic L˙	Freon-11	15.2	1.8	ozone + methyl linoleate, −40°C	81PR01
Methyl linoleate-C˙	Freon-11	15.2	1.8	[2.0066] ozone + methyl linoleate	81PR03
Lipid radicals	W(C9.0)	15.		microsomes + CCl_4	82AL01
Linoleic-C˙ (9 or 13)	W/EtOH 1:1	15.9	1.5	gamma irradiated linoleic acid	81TA01
Linoleic-C˙	W(C9.0)	15.3	2.1	linoleic acid + lipoxygenase	82AL01
Linolenic-C˙	W(C9.0)	15.7	2.0	linolenic acid + lipoxygenase	82AL01
Oleate radical	THF	14.77	1.72	A_H = 0.50, 0.38, autoxidizing lipids 290 K	84EV01
Linoleate radical	THF	14.75	1.75	A_H = 0.52, 0.39, autoxidizing lipids 290 K	84EV01
Linolenate radical	THF	14.75	1.75	A_H = 0.56, 0.35, autoxidizing lipids 290 K	84EV01
Oleate (C˙)**	THF	14.77	1.60	A_H = 0.53, 0.39, 0.1; oleate autoxidation, 220 K	84EV01
Linoleate (C˙)**	THF	14.75	1.53	A_H = 0.584, 0.548, 0.36, 0.24, 0.09; autoxidation, 220 K	84EV01
Linolenate (C˙)**	THF	14.75	1.49	A_H = 1.25, 0.587, 0.374, 0.08; autoxidation, 220 K	84EV01
Linoleate (C˙ at 13)**	THF	+14.75	+1.53 (H13)	A(H12, H14, H11, H10, Ht-Bu) = −0.58, −0.55, +0.36, −0.24, −0.09 respectively, 220 K	85EV01
Linoleate (C˙ at 12)**	THF	+14.75	1.38 (H12)	A(H13, H11, H14, H10, Ht-Bu) = −0.57, −0.54, +0.36, +0.24, −0.09, respectively, 220 K	35EV01
15-HPETE (˙C-11)	W(P7.8)	15.0	2.25	15-HPETE + RSVM or hematin	86SC01
15-HPETE (˙C-13)	W(P7.8)	13.5	2.35	15-HPETE + RSVM or hematin	86SC01
AA (˙C-11)	W(TR7.5)	15.7	2.5	RSV microsomes + AA	80MA01

Table 3* (*Continued*). MNP Spin Adduct Parameters (Also referred to as *t*-NB and NtB)†

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
AA (chemical)	W(TR9.0)/EtOH 1:1	15.5	2.0	nonradical addition of AA to MNP	80MA01
AA—C'	W(C9.0)	14.4	2.75	arachidonic acid + lipoxygenase	82AL01
AA ('C-11 or 'C-15)	W(P7.8)	15.6	2.3	RSVM + AA	86SC02
AA deuterated "	W(P7.8)	15.6		RSVM + AA	86SA02
AA unidentified C'	W(P7.8)	15.9		RSVM + AA	86SC02
2-Azidoprop-2-yl	Benzene	15.2		A_N = 1.70, [2.0059] isopropyl-azide + TBHN	83CO01
α-Azidobenzyl	Benzene	14.3	1.85	A_N = 2.35, [2.0061] benzyl azide + TBHN	83CO01
'OH then + e^-	W	28.0	4.4	radiolysis of water	76SA01
'OH (? see 79KA01)	W(P7.4)	14.4	14.4	Fenton system	79LA03
n-BuO'	Benzene	28.4	1.3	tributyltin chromate	81RE01
tert-BuO'	Benzene	26.6		(*tert*-BuO—OCO)$_2$	70PE01
tert-BuO'	Toluene	27.2		*tert*-ButylOOC(O)C(O)-*tert*-Butyl	77OH01
tert-BuO'	Benzene	26.8		*tert*-ButylOOC(O)C(O)-*tert*-Butyl	80NI01
Alkoxyl radical	2-MP	29.2	1.1(2)	ozonation of 2-MP	83PR02
tert-Butylperoxy[^{17}O]	Toluene	28.7		A(17-O) = 4.6, from 2-propyl-*t*-butyl trioxide	77HO01
or isopropylperoxy[^{17}O]	Toluene	28.7		A(17-O) = 4.6, from 2-propyl-*t*-butyl trioxide	77HO01
Cl_3COO'	CCl_4	27.0		gamma irradiation	82SY01
Cysteinyl	W(P7.6)	18.4		[2.0065] cysteine + hematoporphyrin + light	83FE01
GS'	W(P7.6)	18.3		[2.0065] GSH + hematophorphyrin + light	83FE01
GS'	W(P7.6)	18.5		styrene + PHS + GSH + H_2O_2	86ST01
SO_3^-	W(P7.5)	14.8		cysteine sulfinic acid + HRP/H_2O_2	84HA02
SO_3^-	W(8.5)	14.87		chloramine-T and light or dithionite	85EV03
SO_3^-	W	14.76		PBN + peroxydisulfate + UV	84RE04
$'SO_2NH_2$	W(4.0)	13.9		[2.0055] benzylsulfonamide + UV	80CH03
$'SO_2NH_2$	W(8.5)	14.01		chloramine-T + light	85EV03
$CH_3C_6H_4SO_2$'	W(8.5)	13.12		chloramine-T + light	85EV03
$H_2NC_6H_4SO_2$'	W(4.0)	13.3		[2.0056] sulfacetamide + UV	80CH03
$'SO_2CH_2CH(NH_3)$—COO^-	W(P7.5)	12.7		cysteine sulfinic acid + HRP/H_2O_2	84HA02
p-XC_6H_4S'	Benzene	17.03–18.18		photolysis of corresponding disulfide	83IT01
[*X* = Br, Cl, H, *tert*-butyl, CH_3, OCH_3, NH_2 in the order of increasing *A*.]					
$'AsO_2$	W	14.1		A(As, I = 3/2) = 7.72, $SO_4^{\cdot-}$ + AsO_2^-	84RE01
DTBN [see also $(CH_3)_3C$']					
DTBN	Benzene	15.2		from MNP	70PE01
DTBN	Benzene	15.2		*tert*-butyl radical from decomposition of MNP	75SA01
DTBN	Toluene	15.7		[2.0063], di-*tert*-butyl ketone + UV, 183 K	77HO01
DTBN	W	17.0		MNP, proflavine + 440 nm light	78LI01
DTBN	W	not given		UV and gamma-radiolysis	†81MA01
DTBN	W/EtOH 1:1	16.7		commercial	81TA01
DTBN	Benzene	15.4		[2.0061], isopropylazide + TBHN	83CO01
DTBN	W/MeOH 1:1	16.3		[2.0055] photodecomposition of bleomycin	85AN01
DTBN	W(8.5)	17.16		[2.0055] chloramine-T + light	85EV03
DTBN	W(P7.8)	17.1		RSVM + AA	86SC02

*There are many spin trapping studies on the free radicals generated by gamma-irradiation and UV photolysis of nucleic acids and their constituents, amino acids and peptides. These detailed studies demonstrate and identify the many radicals generated in these systems. Thus, the original papers must be consulted. Only a small sampling of these radical adducts of MNP are included here. The original work in this area can be found in references: 76JO01, 76KO01, 77RU01, 77RU02, 78JO01, 78JO02, 78RU01, 78RU02, 78RU03, 78RU04, 78RU05, 78RU06, 78RU07, 79MA01, 79MA02, 79MA03, 79RI01, 80LI01, 80MA03, 80MA04, 80MA05, 80MA06, 80MI01, 80MI02, 80MO01, 81KU01, 81KU02, 81KU03, 81LI01, 81RO03, 81RO04, 81MO01, 81MO02, 81SU01, 82ET01, 82LI02, 82LI03, 82MA03, 82MA04, 82MO02, 82MO03, 82MO04, 82RI01, 82RO04, 82SP01, 83LI01, 83MA03, 83MA04, 84IG01, 84MA02, 84MO05, 84MO06, 85CA01, 85MA02, 86KU01.

†Reference 81MA01 provides a good deal of information on the chemistry of MNP which might interfere in spin trapping experiments. See also 80MA07.

‡(—COOH) represents decarboxylation of the amino acid.

**These entries represent hyperfine coupling constants derived from the use of ENDOR to study the spin adducts of autoxidizing fatty acids. Here H10 implies the coupling from the proton(s) on carbon 10 of the fatty acids, etc.

§Note that this is the same as the 'OH adduct of PBN.

Table 4. POBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
H·	W	16.6	10.25(2)	TiO + light with MeOH	82AU01
H·	W	16.2	10.2(2)	ultrasound in water	85RI01, 82MA01
H·	W	16.2	10.2(2)	ultrasound in water	85RI01, 83MA01
H·	W(6.7)	16.2	10.2(2)	gamma-irradiation of water, kinetics given	84CA01
D·	D_2O	16.2	10.2	A_D = 1.5, ultrasound in D_2O	85RI01, 83MA01
·CH_3	W(7)	15.83	2.16	[2.0059] cobaltoxime photolysis	82MA06
·CH_3	W(P7.4)	16.12	2.77	HRP/H_2O_2 + 1,2-dimethylhydrazine	85AU01
·CH_3	W(P7.4)	16.0	2.7	microsomes + 1,2-dimethylhydrazine	85AU01
·CH_3	W(P7.4)	16.00	2.72	microsomes + 1,2-dimethylhydrazine, extract	85AU01
·CH_3	Benzene	14.76	2.53	HRP/H_2O_2 + 1,2-dimethylhydrazine	85AU01
·CH_3	Benzene	14.73	2.55	microsomes + 1,2-dimethylhydrazine	85AU01
·CH_3	W/DMSO 19:1	15.2	2.4	diaziquone + DMSO + light	85MO02
·CH_3	W(P7.8)	16.33	2.61	primaquine + NADH + DMSO	86AU01
·CH_3	W and Cells	15.9	2.65	radiolytic generation with DMSO	86SA01
·CH_2OH	C/M 2:1	14.78	3.56	Fenton system with MeOH	86AL02
·CH_2CH_3	W(P7.4)	15.78	2.73	DDEP + microsomes (P-450) or Cu(II)	82AU02
·CH_2CH_3	Benzene	14.43	2.50	DDEP + Cu(II)	82AU02
·CH_2CH_2OH	W(7)	15.75	2.75	[2.0044] cobaltoxime complex photolysis	82MA06
CH_3C·HOH	W(P7.4)	15.56	2.59	H_2O_2 + UV with EtOH	82FI01
CH_3C·HOH	W(P7.4)	15.60	2.65	decomposition of 4-POBN-OOH with EtOH	82FI01
CH_3C·HOH	W	15.5	2.6	ultrasound in water	85RI01, 83MA01
CH_3C·HOH	C/M 2:1	14.97	3.48	liver microsomes + EtOH	86AL01
[^{13}C]CH_3C·HOH	C/M 2:1	not given		but shown, liver microsomes + labeled EtOH	86AL01
CH_3C·HOH	C/M 2:1	14.97	3.48	liver microsomes + EtOH	86AL02
CH_3C·HOH	C/M 2:1	14.97	3.50	Fenton system + EtOH	86AL02
[^{13}C]CH_3C·HOH	C/M 2:1	14.97	3.47	A(13-C) = not given spectra shown; microsomes	86AL02
CH_3C·HOH	W(P7.8)	15.50	2.50	paraquat + NADH + EtOH	86AU01
$(CH_3)_2C$·OH	W(P11.0)	15.6	2.6	Fe(III)-TTPS + UV with 2-PrOH	84FA01
$(CH_3)_2C$·OH	C/M 2:1	14.98	2.67	microsomes + 2-PrOH	86AL02
$(CH_3)_2C$·OH	C/M 2:1	15.13	2.92	Fenton reaction + 2-PrOH	86AL02
2-Phenylethyl	W(P7.4)	15.73	2.75	[2.006] phenelzine + microsomes or Cu(II)	83OR01
2-Phenylethyl	Benzene	14.41	2.68	phenelzine + Cu(II)	83OR01
Phenylethyl	W(P8.0)	not given		phenylethylhydrazine and oxyhemoglobin	84AU01
2-BuOH (C·)	C/M 2:1	15.10	2.56	microsomes + 2-BuOH	86AL02
2-BuOH (C·)	C/M 2:1	15.18	2.64	Fenton reaction + 2-BuOH	86AL02
$CO_2^{\cdot-}$	W	15.6	3.4	TiO + light with formate	82AU01
$CO_2^{\cdot-}$	W(B9.0)	15.8	3.4	formate + *M. formicicum*	83BA01
$CO_2^{\cdot-}$	W	15.5	3.0	ultrasound in water	85RI01, 83MA01
$CO_2^{\cdot-}$	W(6.7)	15.6	3.4	gamma-irradiation of water, kinetics given	84CA01
$CO_2^{\cdot-}$	W(P11.0)	15.5	3.0	Fe(III)-TPPS + light with formate	84FA01
$CO_2^{\cdot-}$	W/DMSO 19:1	15.5	3.0	diaziquone + formate + light	85MO02
·CCl_3	W	14.8	1.5	CCl_4 + UV, then extracted to water	82RO01
L·	W(P7.4)	15.7	2.5	microsomes + 1,2-dimethylhydrazine	85AU01
Linoleate-C·	W(B9.0)	15.8	2.56	lipoxygenase + linoleate	86CO02
Lipodienyl-type	C/M 2:1	14.84	2.87	hepatocytes + $FeSO_4$	86PO01
Lipodienyl-type	C/M 2:1	14.80	2.90	hepatocytes + ADP-$FeCl_3$	86PO01
$CH_3C_6H_4SO_2N$·(H)	W(5)	15.00	2.25	A_N = 2.25, chloramine-T in acid	85EV02
Unidentified	W	15.6	2.6	1% H_2O_2 + UV light	78JA01
N_3·	W	14.8	2.0	A_N = 2.0, methylene blue + light with azide	82HA02
N_3·	AcN	13.87	1.43	A_N = 2.09, electrochemical	82WA02
·OH	W(2–10)	14.97	1.68	A_H = 0.34, 1% H_2O_2 + UV light, mean for A's	78JA01
·OH	W(2–6)	14.97	1.68	A_H = 0.36, 0.05M $Na_2S_2O_8$	78JA01
·OH	W	14.96	1.68	$FeCl_3$ + ADP + H_2O_2	78JA01
·OH	W(P7.8)	14.93	1.69	H_2O_2 + UV light	79FI01
·OH	W	14.95	1.68	A_H = 0.33, TiO + light	82AU01
·OH	W(P7.4)	14.93	1.69	H_2O_2 + UV	82FI01
·OH	Benzene	14.5	1.8	troposphere ·OH, on filter then extracted	82WA01
·OH	Benzene	14.4	1.8	·OH trapping in an atmospheric model	82WA01
·OH	W	14.95	1.67	A_H = 0.33, H_2O_2 + UV light	85TA01
·OH	W(2.3)	15.1	1.66	A_H = 0.3, persulfate + $AgNO_3$	86MO03
[^{17}O]·OH	W(2.3)	15.1	1.66	A(17-O) = 3.9, persulfate + $AgNO_3$	86MO03
·OOH	W(P7.8)	14.16	1.75	xanthine + xanthine oxidase	79FI01
·OOH	W(P7.4)	14.16	1.80	microsomes/paraquat/NADPH	86CO02
[^{17}O]·OOH	W(P7.4)	14.16	1.80	A(17-O) = 3.60, microsomes/paraquat/NADPH	86CO02
·OOH	W(P7.4)	14.18	1.72	microsomes/paraquat/NADPH	86MO03
[^{17}O]·OOH	W(P7.4)	14.18	1.72	A(17-O) = 3.6, microsomes/paraquat/NADPH/ $^{17}O_2$	86MO03

Table 4 (*Continued*). POBN Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
LOO· (? see 86CO02)	W(B9.0)	15.8	2.6	lipoxygenase + linoleic acid	81RO02, 81RO01
LOO· (? see 86CO02)	W(B9.0)	15.8	2.6	microsomes + NADPH	81RO02, 81RO01
LOO· (? see 86CO02)	W(P7.4)	15.8	2.6	microsomes + NADPH ± CCl_4	82RO02
LOO· (? see 86CO02)	W(P7.4)	15.8	2.6	liver homogenate + MLOOH	85MI01
LOO· (? see 86CO02)	W(P7.4)	15.8	2.6	N-hydroxynorcocaine + microsomes	82RO03
LOO· (? see 86CO02)	W(P7.4)	15.8	2.6	Microsomes + nitrozepam	84RO04
LOO· (? see 86CO02)	W(P7.4)	15.8	2.6	microsomes + MLOOH	85MI01
LOO· (? see 86CO02)	C/M 2:1	16.1	2.7	liver extract with AOML in vivo	85MI02
GS·	EtOH/W 5:1	15.13	2.32	α-chromanoxyl radical + GSH	82NI01
GS·	Benzene	15.23	2.28	*tert*-butoxyl radical + GSH	82NI01

Table 5. M_4PO—3,3,5,5-tetramethylpyrroline-*N*-oxide (sometimes referred to as TMPO)

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
H·	MeOH	15.56	19.8(2)	*n*-Bu_3SnH	81JA01
H·	Benzene	14.61	18.29(2)	*n*-Bu_3SnH	81JA01
·CH_3	W	16.60	27.00	H_2O_2 + UV	81JA01
·CH_2OH	MeOH	15.12	21.99	Ph_2CO + light	81JA01
Phenyl	Benzene	14.41	23.86	phenylazotriphenylmethane	81JA01
Phenyl	W(P7.4)	16.2	27.2	phenylhydrazine + erythrocytes	82HI02
Phenyl	W(P7.4)	16.2	27.2	[2.0045] phenylhydrazine + erythrocytes	83HI01
$C_6H_5C^{\cdot}(=O)$	DBPO	14.18	14.18	di-*tert*-butylperoxalate	81JA01
$(CH_3)_2NC^{\cdot}(=O)$	DBPO	13.59	13.59	di-*tert*-butylperoxalate	81JA01
$CO_2^{\cdot-}$	W	15.71	19.85	di-*tert*-butylperoxalate with formate	81JA01
$N_3^{\cdot}$	W	14.88	14.88	A_N = 2.98, azide with peroxydisulfate	81JA01
·OH	W(P6)	15.30	16.88	30% H_2O_2 + UV	81JA01
·OH	W(P6)	15.28	16.73	1% H_2O_2 + UV	81JA01
·OH	W(P6)	15.29	16.81	peroxydisulfate	81JA01
·OH	W(2)	15.29	16.82	peroxydisulfate	81JA01
$O_2^{\cdot-}$	Benzene	13.38	7.95	KO_2	81JA01
·OOH (tentative)	W(P6)	15.67	20.01	1% H_2O_2 + UV	81JA01
·OOH	W	15.7	20.0	[2.0060]	85TH02
tert-BuO·	Benzene	13.31	5.81	di-*tert*-butylperoxalate	81JA01
tert-BuO·	Toluene	13.28	5.42	photolysis of *tert*-butyl hydroperoxide	86DA02
tert-BuO·	Benzene	13.39	5.88	di-*tert*-butylperoxide	82HA01
tert-BuO·	Di-*tert*-butylperoxide	13.16	4.90	di-*tert*-butylperoxide	82HA01
Cumene alkoxyl	Toluene	13.12	4.56	photolysis of dicumylperoxide	86DA02
Oleic alkoxyl	Toluene	13.12	4.32	UV photolysis of peroxidized oleic acid	86DA02
Linoleic alkoxyl	Toluene	13.28	4.32	UV photolysis of peroxidized linoleic acid	86DA02
Linolenic alkoxyl	Toluene	13.28	4.32	UV photolysis of peroxidized linolenic acid	86DA02
Arachidonic alkoxyl	Toluene	13.28	4.56	UV photolysis of peroxidized arachidonic acid	86DA02
$C_6H_5C(=O)O^{\cdot}$	Benzene	12.53	7.97	$(PhC(=O)O)_2$	81JA01
$SO_4^{\cdot-}$	W(P6)	14.04	8.34	peroxydisulfate	81JA01
$SO_4^{\cdot-}$	W(2)	13.99	8.33	peroxydisulfate	81JA01
$CH_3S^{\cdot}$	W(7.4)	15.47	17.07	UV photolysis of disulfide	87DA01
$CH_3CH_2S^{\cdot}$	W(7.4)	15.60	17.60	UV photolysis of disulfide	87DA01
$HOCH_2CH_2S^{\cdot}$	W(7.4)	15.47	17.87	UV + H_2O_2 with 2-mercaptoethanol	87DA01
$HOOCCH_2S^{\cdot}$	W(7.4)	15.30	17.80	UV + H_2O_2 with 2-mercaptoethanoic acid	87DA01
$NH_2CH_2CH_2S^{\cdot}$	W(7.4)	15.60	19.20	UV + H_2O_2 with 2-mercaptoethylamine	87DA01
Homocystine-S·	W(7.4)	15.47	18.13	UV photolysis of homocystine	87DA01
$HOOC(CH_2)_2S^{\cdot}$	W(7.4)	15.46	18.00	UV photolysis of 3,3'-dithiopropionic acid	87DA01
$HOOC(CH_2)_3S^{\cdot}$	W(7.4)	15.47	18.00	UV photolysis of 4,4'-dithiobutyric acid	87DA01
Cysteinyl	W(7.4)	weak		UV photolysis of cystine	87DA01
GS·	W(7.4)	15.00	18.13	UV photolysis of glutathione disulphide	87DA01
2-Mercaptopropionyl	W(7.4)	15.33	18.13	UV + H_2O_2 with 2-mercaptopropionyl-glycine	87DA01

Table 6. Nitrosodurene or ND (2,3,5,6-tetramethylnitrosobenzene)

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
$^{\cdot}CH_3$	Benzene	13.70	12.17(3)	A(para-H) = 0.34, methyliodide + tri-*n*-butyltin	73TE01
$^{\cdot}CH_3$	GA/MeOH 1:1	14.4	13.1(3)	Cr(IV) complex + UV	79RE04
$^{\cdot}CH_3$	GA/i-PrOH 1:1	14.4	13.2(3)	Cr(IV) complex + UV	79RE04
$^{\cdot}CH_3$	GA	14.4	13.3(3)	$UO_2(NO_3)_2$ + UV	82RE03
$^{\cdot}CH_3$	Benzene	13.7	12.9(3)	sonolysis of $(CH_3)_3SnSn(CH_3)_3$	84RE05
$^{\cdot}CH_2OH$	MeOH	13.91	7.71(2)	di-*tert*-butyl peroxide + MeOH + UV	73TE01
$^{\cdot}CH_2OH$	GA/MeOH 1:1	14.4	8.2(2)	Cr(IV) complex + UV	79RE04
$^{\cdot}CH_2CH_3$	Benzene	13.68	10.97(2)	ethylbromide + tri-*n*-butyltin	73TE01
$^{\cdot}CH_2CH_3$	Proprionic acid	14.4	11.2(2)	$UO_2(NO_3)_2$ + UV	82RE03
$^{\cdot}CH_2CH_3$	Benzene	13.6	10.1(2)	sonolysis of $Sn(CH_2C_6H_5)_3Cl$ + ethyliodide	84RE05
$^{\cdot}CH_2CH_3$	Benzene	13.6	10.0(2)	sonolysis of Sn(methyl)$_4$ with ethyliodide	84RE05
$^{\cdot}CH_2CN$	AcN	13.49	9.67(2)	diazonium salt + ultrasound	84RE07
$CH_3C^{\cdot}HOH$	GA/EtOH 1:1	13.7	6.7	Cr(IV) complex + UV	79RE04
$^{\cdot}CH_2COOH$	GA	12.4	6.3	Cr(IV) complex + UV	79RE04
$^{\cdot}CH_2COOH$	GA	12.3	6.2(2)	$UO_2(NO_3)_2$ + UV	82RE03
n-Propyl	Proprionic acid	14.3	11.3(2)	$UO_2(NO_3)_2$ + UV	82RE03
iso-Propyl	Benzene	13.72	6.92	2-bromopropane + tri-*n*-butyltin	73TE01
iso-Propyl	iso-Proprionic acid	14.3	9.1	$UO_2(NO_3)_2$ + UV	82RE03
iso-Propyl	Benzene	13.7	7.0	sonolysis of $Sn(Bu)_2(Phenyl)_2$ + 2-iodopropane	84RE05
iso-Propyl	Benzene	13.37		pesticide photolysis	85MI02
$C_2H_5C^{\cdot}HOH$	GA/*n*-PrOH 1:1	14.7	2.7	Cr(IV) complex + UV	79RE04
$CH_3C^{\cdot}(OH)CH_3$	GA/iso-PrOH 1:1	14.3		Cr(IV) complex + UV	79RE04
n-Bu$^{\cdot}$	Benzene	13.4	10.4	A(13-C) = 7.0, tributyltin chromate	81RE01
n-Bu$^{\cdot}$	CH_2Cl_2	13.7	10.9	A(13-C) = 7.0, tributyltin chromate	81RE01
n-Bu$^{\cdot}$	Benzene	13.49	10.65(2)	A_H = 0.75(2), sonolysis of $Bu_3SnSnBu_3$	84RE05
tert-Bu$^{\cdot}$	Benzene	13.60		*tert*-butylbromide + tri-*n*-butyltin	73TE01
$^{\cdot}C_{14}H_{20}NO_3$*	AcN	10.11	2.90	diazonium salt + ultrasound	84RE07
$^{\cdot}C_{14}H_{20}NO_3$*	Benzene	10.12	2.88	A_H = 0.99, diazonium salt + ultrasound	84RE07
$^{\cdot}CHO$	CH_2Cl_2	6.8	1.6	dichromate + UV	82RE01
$^{\cdot}COCl$	CH_2Cl_2	8.4		dichromate + UV	82RE01
$^{\cdot}CHCl_2$	CH_2Cl_2	11.13	1.14	A(Cl) = 3.01(2), CH_2Cl_2 + di-*tert*-butyl peroxide + UV	73TE01
$^{\cdot}CHCl_2$	$CHCl_3$	11.1	1.1	A(Cl) = 3.0, dichromate + UV	82RE01
$^{\cdot}CCl_3$	Benzene	10.73		A(Cl) = 1.31(3), di-*tert*-BuOO + $CHCl_3$ + UV	73TE01
$^{\cdot}CCl_3$	CCl_4/CH_2Cl_2 9:1	10.7		A(Cl) = 1.3, dichromate + UV	82RE01
Benzyl	Benzene	13.61	7.93	di-*tert*-butyl peroxide + toluene + UV	73TE01
Benzyl	Toluene	13.4	7.48	gamma-radiolysis	78ZO01
†Benzyl, substituted-from pesticide photolysis. See also 82MI02.					
Phenylethyl	Benzene	13.59	10.87(2)	1-phenyl-2-bromoethane + tri-*n*-butyltin	73TE01
Cumyl	Benzene	13.59		[2.0064] 2-phenylpropane + *tert*-BuO$^{\cdot}$	73TE01
Benzoyl	Benzene	7.24		benzaldehyde + di-*tert*-butyl peroxide + UV	73TE01
Phenyl	Benzene	10.11		[2.0057] benzoyl peroxide + UV	73TE01
Phenyl	Benzene	10.1	2.76(3)	A_H = 0.95(2), gamma-irradiation	78ZU01
Phenyl	Benzene	10.1	2.75(3)	A_H = 0.95(2), gamma-irradiation	78ZU02
Phenyl	AcN	10.47	2.86(3)	A_H = 0.98(2), diazonium compounds + ultrasound	84RE07
Phenyl	Benzene	10.08	2.79(3)	A_H = 0.95(2), diazonium compounds + ultrasound	84RE07
Phenyl	Benzene	10.10	2.75(3)	A_H(meta) = 0.95(2), decay of tritiated Benzene	85HA01
Phenyl	Benzene	10.1	2.8(3)	sonolysis of $(phenyl)_3SnSn(phenyl)_3$	85RE05
p-$HOC_6H_4^{\cdot}$	Benzene	11.80		A_H = 3.25, 2.75, 0.83(3) [2.0050] Ni-peroxide + PhOH	73TE01
$N_3^{\cdot}$	MeOH	7.34(2)		A_N = 2.29, photolysis of cobalt azido complex	79RE02
$N_3^{\cdot}$	$MeOH/CH_2Cl_2$	7.3(2)		A_N = 2.3 [2.0059] metal complex + UV and azide	79RE05
$^{15}N_3^{\cdot}$	W	7.7(2)		A(15-N) = 3.3, H_2O_2 + azide + UV	82KR01
$N_3^{\cdot}$	CH_2Cl_2	7.21(2)		A_N = 2.38, tetrabutylammonium azide + UV	84RE04
$N_3^{\cdot}$	CH_2Cl_2	7.21(2)		A_N = 2.38, tetrabutylammonium azide + UV	84RE06
$^{\cdot}NCO$	CH_2Cl_2	7.23(2)		A_N = 2.40, tetraamonium cyanide + UV	84RE06
iso-BuO$^{\cdot}$	GA/iso-BuOH 1:1	26.7		Cr(IV) complex + UV	79RE04
tert-BuO$^{\cdot}$	Benzene	25.18		di-*tert*-butyl peroxide + UV	73TE01
tert-BuO$^{\cdot}$	GA/*tert*-BuOH 1:1	27.8		Cr(IV) complex + UV	79RE04
$CH_3S^{\cdot}$	Benzene	16.48		[2.0068] photolysis of disulfide	73TE01
n-propyl-S$^{\cdot}$	Benzene	16.82		[2.0068] photolysis of disulfide	73TE01
Phenyl-S$^{\cdot}$	Benzene	16.01		[2.0057] photolysis of disulfide	73TE01

*2,5-Diethoxy-4-(*N*-morpholino)phenyl.

†The hyperfine splittings for nine substituted benzyl adducts of nitrosodurene, as well as these same radical adducts of *N*-benzylidene-*tert*-butylamine *N*-oxide, are presented in 85MI04.

**The hyperfine splittings for 34 different aryl and arylcyclohexadienyl duryl nitroxides are presented in 76SU01.

Table 7. Other Spin Trap Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
4-PyBN—4-pyridyl-N-tert-butyl nitrone					
H·	W	16.0	10.0	ultrasound in water	82MA01
Phenyl	30 different	14.06–15.73	1.77–3.57	PAT	82JA01
		$A_H = 1.06A_N$–13.08		for the phenyl radical	82JA01
N_3·	W	14.68	1.95	A_N = 1.95, e^- irradiation	80KE01
·OH	W	15.0	1.9	e^- irradiation	80KE01
4-MePyBn—4-(N-methylpyridinium) tert-butyl nitrone					
H·	W(P3.0)	15.51	6.24(2)	peroxydisulfate	79JA01
H·	W	16.0	10.0(2)	ultrasound in water	85RI01, 83MA01
D·	D_2O	16.0	10.0	A_D = 1.5, ultrasound in water	85RI01, 83MA01
·CH_2OH	W(6)	15.23	2.59	H_2O_2 + UV with MeOH	80MA01
Phenyl	W	15.20	2.88	electrochemical	82WA02
·OH	W(P6.0)	14.70	1.45	A_H = 0.38, H_2O_2 + UV	79JA01
·OH	W(6)	14.81	1.45	H_2O_2 + UV	80MA02
·OH	W	14.7	1.5	A_H = 0.4, ultrasound in water	85RI01, 83MA01
"·OH"	W	14.70	1.45	Blue dye No. 1 + light, not ·OH	85CA01
·OD	D_2O(P6.0)	14.76	1.43	H_2O_2 + UV	79JA01
·OOH	W(P7.0)	13.78	1.65	[2.0091] pheomelanin + light or XOD	80SA01
·OOH	W	13.80	1.58	adriamycin or daunomycin + light	83CA01
$·SO_4^-$	W(P6.0)	13.96	1.21	peroxydisulfate	79JA01
Cl·	AcN	12.27	0.82	A(Cl-35,37) = 6.20, 5.12; electrochemical	82WA02
DMNS—perdeuterio 2,4-dimethyl-3-nitrosobenzenesulfonate					
SDS alkyl radical	Micelle	14.7	9.1	photoreduction of naphthoquinone	85OK01
DOPBN—α-(4-dodecyloxyphenyl)-N-tert-butyl nitrone					
Phenyl	W/SDS	15.05	3.19	phenylazotriphenylmethane in micelles	81WA01
Phenyl	W/SDS	15.02	3.22	phenyldiazonium tetrafluoroborate in micelles	81WA01
Phenyl	W/AN 1:1	15.05	3.21	phenylazotriphenylmethane	81WA01
Phenyl	W/AN 1:1	15.06	3.23	phenyldiazonium tetrafluoroborate	81WA01
Phenyl	W/AN 1:1	15.08	3.19	phenyllithium	81WA01
Phenyl	Vesicles	14.73	2.81	DODAC/DOPBN vesicles + PAT	82WA02
Phenyl	Vesicles	14.77	2.70	DODAC/DOPBN vesicles + PDT	82WA02
Phenyl	Vesicles	14.76	2.75	lecithin/DOPBN vesicles + PAT	82WA02
Phenyl	Vesicles	14.77	2.75	lecithin/DOPBN + PDT	82WA02
Phenyl	$CHCl_3$	14.70	2.73	phenyllithium	82WA02
Phenyl	W/SDS	15.29	3.56	phenylazo-4-pyridyldiphenylmethane	84JA02
2-SSPBN—Sodium 2-sulfanatophenyl tert-butylnitrone					
Phenyl	W	15.98	5.90	phenylazo-4-pyridyldiphenylmethane	84JA02
N_3·	AcN	14.36	2.97	A_N = 2.17, electrochemical	82WA02
·OH	W	15.7	5.2	octacyanomolybdate(V) + UV	82RE02
"·OH"	W	15.71	5.28	sodium persulfate	84JA02
"·OH"	W/SDS	15.71	5.28	sodium persulfate with SDS micelles	84JA02
MNPOL—2-Methyl-2-nitroso-1-propanol					
H·	W(B9.0)	15.7	26.2	$NaBH_4$ or microsomes + NADPH	81RO01
lipid radical	W(B9.0)	16.6	2.1	lipoxygenase + linoleic acid	81RO01
HO(MO)$_2$PBN—(2-hydroxy-4,6-dimethyloxyphenyl tert-butyl nitrone)					
L·	Folch	15.45	2.07	in vivo CCL_4 in rat liver, extracted	84MC01
$^{13}·CCl_3$	AcN	14.31	2.35	$A(^{13}C)$ = 9.02, in vivo rat liver, extracted	84MC01
"·OH"	W	16.21	8.85	hexachloroplatinate(IV) + light, Cl hydrolysis	84RE01
tert-butylhydronitronide?	Folch	14.5	13.8	in vivo hydrolysis of $(MO)_2$PBN	84MC01
Nitrosobenzene					
$CH_3(CN)C$·	Benzene	11.54	2.18(3), 0.86(2)	azobisisobutyronitrile	82BE01
Phenyl radical	Benzene	9.60	1.79(6), 0.80(4)	benzoyl peroxide	82BE01
α-methylbenzyl	W(TR3.0)	14.0	5.0	A_H = 3.4, 1.1; lignin model + ligninase	86HA01
α,α-dimethylbenzyl	W(TR7.4)	12.6		A_H = 1.0; lignin model + ligninase	86HA01
Carbon radical	W(P7.5)	not given		[2.006] retinoic acid and haematin	86IW01
p-XC_6H_4S·	Benzene	11.53–12.00		A(H,2) = 2.50–2.60, A(H,1) = 0.95–1.00	83JT01
	X = Br, Cl, H, *tert*-Butyl, CH_3, OCH_3, NH_2 photolysis of respective disulfide.				
MDN—methyl-N-durylnitrone					
Methyl linoleate-C·	Benzene	14.32	6.46	methyl linoleate + *tert*-BuO·	84YA01
·OOH	Benzene/*tert*-BuOH	13.12	4.67	[2.0059] H_2O_2 + UV	82KO03

Table 7 (*Continued*). Other Spin Trap Spin Adduct Parameters

Adduct	Solvent	A_N/G	A_H/G	Other, [g-value], Source	Reference(s)
[*MDN Continued*]					
tert-BuO·	Benzene	13.13	7.91	di-*tert*-butyl peroxide + UV	82KO03
tert-BuO·	Benzene/*tert*-BuOH	12.82	4.76	[2.0059] di-*tert*-butyl peroxide + UV	82KO03
tert-BuO·	Benzene	14.10	7.47	*tert*-BuOOC(O)C(O)OO-*tert*-Bu	83NI01
LO·	Benzene	13.35	6.25	LOOH + Co(II)	83NI01
Tetralyloxyl	Benzene	13.08	5.95	tetralylOOH + Co(II)	83NI01
tert-BuOO·	Benzene	12.80	4.61	*tert*-BuOOH + *tert*-BuO·	83NI01
MDN Continued					
LOO·	*Benzene*	*12.45*	*4.69*	*LOOH + tert*-BuO·	83NI01
Tetralyldioxyl	Benzene	12.63	4.55	tertralylOOH + *tert*-BuO·	83NI01
CH_3S·	Benzene	12.67	4.44	A_H = 0.90(3), 0.45(4) disulfide photolysis	82KO03
CH_3CH_2S·	Benzene	12.78	4.80	A_H = 0.57(6) photolysis of disulfide	82KO03
n-Propyl-S·	Benzene	12.78	4.80	A_H = 0.56(4) photolysis of disulfide	82KO03
Phenyl-S·	Benzene	12.61	5.36	A_H = 0.45(4) photolysis of disulfide	83KO03
*DBNBS—3,5-dibromo-4-nitrosobenzene sulfonate**					
·CH_3	W	not given		DMSO and base + H_2O_2	86OZ01
O_2^- (? see 87ST01)	W(P7.2)	12.63	0.71(2)	[2.0066] xanthine oxidase or DMSO, basic	86OZ01
SO_3^-	W	12.9	0.8(2)	[2.0063] sulfite + Ce(IV) or H_2O_2	87OZ01
SO_3^-	W/DMSO 1:1	12.6	0.62(2)†	decomposition of DMSO in base	87ST01
Proline					
·OH	W(CH7.1)	15.8	21.3(2)	A_H = 17.7, ADP-Fe(II)-H_2O_2	84FL02
Hydroxyproline					
·OH	W(CH7.1)	15.4	25.6, 20.3	A_N = 1.51, ADP-Fe(II)-H_2O_2	84FL02
TMPO—2,5,5 trimethyl-1-pyrroline-1-oxide					
H·	Benzene	14.30	20.53	A_H = <1.0, photolysis of *n*-Bu_3SnH	73JA02
F·	Benzene	11.74		A_H = 1.63(2), A_F = 52.7, silver difluoride	73JA01
tert-BuO·	Benzene	12.90		A_H = 2.30, DBPO	73JA02
$C_6H_5C(=O)—O$·	Benzene	12.71		A_N = 1.2, 0.7; $(C_6H_5CO_2)_2$	73JA02
·OOH	W(P7.8)/DMF 10/1	15.6		tetramethylammonium superoxide	79FI01

*See reference 81KA01 for the initial work with this spin trap. In addition, reference 82ET01 provides results from gamma-irradiated amino acids.
†Additional hyperfine splittings are resolved and assigned.

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APPENDIX—LIST OF ABBREVIATIONS

AA	Arachadonic acid
Ac	Acetate buffer
AcN	Acetonitrile
Act	Acetone
AcPhHZ	1-acetyl-2-phenylhydrazine
Acyl radical	$^{\cdot}C(=O)R$
AOML	Autoxidizing methyl linoleate
B	Borate buffer
BLM	Bleomycin
BP*	Benzophenone triplet
C9.0	Caronate buffer, pH 9.0
Cit	Citrate
CH	Bicarbonate buffer
C/M 2:1	Chloroform and methanol in 2:1 ratio, Folch extraction. Typically the chloroform layer is examined in the ESR for any spin adduct signals.
CPE	Controlled potential electrolysis
CPZ	Chlorpromazine
CPZ-SO	Chlorpromazine sulfoxide
D	Deuterium or ^2H
D_2O	Deuterium oxide
DBPO	Di-*tert*-butylperoxalate
DDEP	3,5-bis(ethoxycarbonyl)-4-ethyl-2,6-dimethyl-1,4-dihydropyridine
Decarb	The carboxyl group of the amino acid is cleaved leaving a carbon-centered radical that is trapped
DMHB	Dimethoxyhydrobenzoin or 1-(3,4-dimethoxyphenyl)-2-phenylethanediol
DMPO	5,5-Dimethylpyrrolidine-1-oxide or 5,5-dimethylpyrrolidine-*N*-oxide
DMPOX	5,5-Dimethyl-2-pyrrolidine-1-oxyl, an oxidation product of DMPO
DMSO	Dimethyl sulfoxide
DODAC	Dioctadecyldimethyl ammonium chloride
DOPA	3,5-dihydroxyphenylalanine
DOPBN	C-(4-dodecyloxyphenyl)-*N*-*tert*-butylnitrone
DTBN	Di-*tert*-butyl nitroxide, a decomposition product of MNP trapped by MNP
ENDOR	Electron Nuclear Double Resonance
EPPS	*N*-2-hydroxyethylpiperazine propane sulfonic acid
EPR	Electron paramagnetic resonance
ESR	Electron spin resonance
EtOH	Ethyl alcohol
Folch	Extraction using C/M 2:1. The chloroform layer is then examined in the ESR
G	Gauss
GA	Glacial acetic acid
Gly	Glycine
GSH	Glutathione
GS$^{\cdot}$	Glutathiyl free radical, sulfur-centered
Halothane	2-bromo,2-chloro,1,1,1-trifluoroethane
HANKS	Hanks balanced salt solution
HEPES	*N*-2-hydoxyethylpiperazine-*N*′-2-ethanesulfonic acid
KHB7.6	Krebs-Henseleit bicarbonate buffer, pH 7.6
HP	Hematoporphyrin
HPD	Hematoporphyrin derivative
15-HPETE	15-Hydroperoxy-eicosatraenoic acid
HRP	Horseradish peroxidase
KRP7.4	Krebs-Ringer phosphate buffer, pH 7.4
L$^{\cdot}$	As carbon-centered radical
LO$^{\cdot}$	Lipid oxy radical, an alkoxy radical
LOO$^{\cdot}$	Lipid hydroperoxy radical
LPC	Egg lecithin phosphatidylcholine
M	MOPS buffer, see MS
MC	Methylene chloride
MeOH	Methyl alcohol
ML	Methyl linoleate
MLOOH	Methyl linoleate hydroperoxide
MNNG	*N*-methyl-*N*′-nitro-*N*-nitrosoquanidine
MNP	2-methyl-2-nitrosopropane = *t*-NB = N*t*B
MNPOL	2-methyl-2-nitroso-1-propanol
M_4PO	3,3,5,5-Tetramethylpyrroline-*N*-oxide
MPP$^+$	1-methyl-4-phenyl pyridinium ion
MS	Morpholinopropane sulphonic acid buffer, often referred to as MOPS
n-Bu	*n*-Butyl
n-BuOH	*n*-Butyl alcohol
ND	Nitrosodurene, 2,3,5,6-tetramethylnitrosobenzene
N*t*B	MNP
P$^{\cdot}$	Promazyl radical, i.e. 10-[3-(dimethylamino)-propyl]-10H-phenothiazin-2-yl
P(7.0)	Phosphate buffer, pH 7.0
PAT	Phenylazotriphenylmethane
PBN	alpha-phenyl-*N*-*tert*-butyl nitrone
PBNOx	Benzoyl *tert*-butyl nitroxide, and oxidation product of PBN
PDT	Phenyldiazonium tetrafluoroborate
PGS	Prostaglandin synthetase
PHS	Prostaglandin H Synthase
PMA	Phorbol myristate acetate
POBN	α-(4-pyridyl-1-oxide) *N*-*tert*-butyl nitrone = 4-POBN
PP	Pyrophosphate buffer
PQ	Paraquat (methyl viologen)
PrOH	Propanol
2-PrOH	Isopropyl alcohol
PRQ	Primaquine

RO· An alkoxy radical
RPMI RPMI cell medium
RSV Ram seminal vesicals
RSVM Ram seminal vesical microsomes
TAR Sodium tartrate buffer
TBA tetra-*n*-butylammonium
$TBABBu_4$ tetra-*n*-butyl ammonium tetra-*n*-butylboride
TBAP tetra-*n*-butyl ammonium perchlorate
t-BB *tert*-Butylbenzene
TBHN Di-*tert*-butylhyponitrite
t-BuOH *tert*-butyl alcohol
TMAS Tetramethylammonium superoxide
TME Tetramethyl ethylene
TMPO 2,5,5-trimethylpyrroline-1-oxide
t-NB *tert*-nitrosobutane = MNP
TPPS Tetraphenylporphyrin sulfonate
TR TRIS buffer
T Tesla
$t_{1/2}$ First order half-life of the spin adduct
W Water
W(10) Water at pH 10
W(P7.4) Water, phosphate buffer, pH 7.4
X.O. Xanthine oxidase