

Vita of Jacob Schaefer
(born: 1938, San Francisco, California)

PRESENT POSITION:

Charles Allen Thomas Professor of Chemistry
Department of Chemistry
Washington University
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EDUCATION:

B.S. in Chemistry, Carnegie Institute of Technology, 1960
Ph.D. in Physical Chemistry, University of Minnesota, 1964

INDUSTRIAL EXPERIENCE:

1964 - 1974	Senior Research Chemist, Monsanto Company
1974 - 1980	Monsanto Fellow, Monsanto Company
1980 - 1986	Senior Monsanto Fellow, Monsanto Company
1986 - 1995	Consultant, Monsanto Company
1989 - 1992	Consultant, Battelle Pacific Northwest Laboratory
1991 - 1994	Consultant, Exxon Research and Engineering Company
1994 - 1996	Consultant, Procter & Gamble Company
1995-	Consultant, Berlex Biosciences

ACADEMIC APPOINTMENTS:

1978 - 1986	Adjunct Professor of Chemistry, Washington University
1986 -	Charles Allen Thomas Professor of Chemistry, Washington University
1989	Rufus Putnam Visiting Professor of Chemistry, Ohio University

CURRENT RESEARCH INTERESTS:

Development of techniques for the nuclear magnetic resonance spectroscopy of solids (sensitivity enhancement, high resolution, relaxation), and the application of these techniques to the study of polymeric and biological solids.

PROFESSIONAL AWARDS AND RECOGNITION:

1977	St. Louis Section Award of the American Chemical Society
1980	Elected a Fellow in the American Physical Society
1982	Monsanto Science and Technology Award
1987	Midwest Award of the American Chemical Society
2003	Laukien Prize of the Experimental NMR Conference
2007	Schulich Lecturer, Technion, Haifa, Israel

EDITORIAL BOARDS:

1981 - 1983	Macromolecules
1984 - 1986	Accounts of Chemical Research
1985 - 1996	Magnetic Resonance in Chemistry
2003-	Journal of Magnetic Resonance

CURRENT FUNDING:

1. "Solid State NMR Analysis of Chain Packing and Dynamics in Polycarbonates" NSF, 2005-2009, DMR-0451685, \$105K/year.
2. "Characterization of Protein Binding Sites by REDOR NMR," NIH, 2003-2007, EB001964, \$275K/year.
3. "Glycopeptide Complexes with Bacterial Cell-Wall Proteins by REDOR NMR," NIH, 2006-2010, EB002058, \$350K/year.
4. "Solid State NMR for Plant Structural Biology," NSF, 2006-2010, MCB-0089905, \$140K/year.

PATENTS:

J. Schaefer and R. A. McKay, "Multi-Tuned Single Coil Transmission Line Probe for NMR Spectrometer, US Patent 5,861,748 (1999).

MINI-BIOGRAPHY

Jacob Schaefer is the Charles Allen Thomas Professor of Chemistry at Washington University. His speciality is high-resolution solid-state NMR. He is the co-inventor of cross-polarization magic-angle spinning (1976) and rotational-echo double resonance (1989). Both techniques have become standard methods and are currently in use world wide. His program has application areas focusing on the determination of structure and dynamics of protein binding sites, channels, and interfaces, and of chain packing in synthetic polymer systems. All of these applications are on materials not suited to diffraction or solution-state NMR measurements.

PUBLICATIONS: (Papers which may be of special interest have titles in boldface.)

1. J. Schaefer
"Random Monomer Distributions in Copolymers. Copolymerizations of Ethylene-Vinyl Chloride and Ethylene-Vinyl Acetate"
J. Phys. Chem., 70, 1975 (1966).
2. M. M. Kreevoy and J. Schaefer
"Vicinal ^1H - ^{199}Hg Coupling Constants"
J. Organomet. Chem., 6, 589 (1966).
3. R. J. Kern and J. Schaefer
"On the Existence of a Free-Radical Organoboron Complex in the Polymerization of Methyl Methacrylate"
Polymer Letters, 5, 157 (1967).
4. R. J. Kern and J. Schaefer
"Catalyst-Controlled Monomer Distributions in Copolymers. Copolymerization of Propylene Oxide and Maleic Anhydride"
J. Amer. Chem. Soc., 89, 6 (1967).
5. J. Schaefer and R. Yaris
"On the Perturbation-Variation Calculation of Spin-Spin Coupling Constants"
J. Chem. Phys., 46, 948 (1967).
6. J. Schaefer and R. Yaris
"A Phenomenological Treatment of the Absolute Signs of Spin-Spin Coupling Constants"
Chem. Phys. Letters, 1, 173 (1967).
7. J. Schaefer, R. J. Katnik, and R. J. Kern
"The Monomer Distributions of Propylene Oxide-Maleic Anhydride Copolymers"
J. Amer. Chem. Soc., 90, 2476 (1968).
8. R. J. Katnik and J. Schaefer
"Structural Isomer Distribution in Ring Polymers of Propylene Oxide"
J. Org. Chem., 33, 384 (1968).
9. J. Schaefer, R. J. Katnik, and R. J. Kern
"Structural Isomer Distribution in Linear Copolymers of Propylene Oxide" Macromolecules, 1, 101 (1968).
10. J. Schaefer, R. J. Kern, and R. J. Katnik
"The Monomer Distributions of Propylene Oxide-Sulfur Dioxide Copolymers" Macromolecules, 1, 107 (1968).
11. J. Schaefer

- "Equilibrium of Catalytic States in the Copolymerization of Propylene Oxide and Sulfur Dioxide"
Macromolecules, 1, 111 (1968).
12. J. Schaefer and J. M. S. Henis
"Electron Density Rearrangement Description of Ion-Molecule Reactions"
J. Chem. Phys., 49, 5377 (1968).
13. J. Schaefer
"Conformations of *cis*- and *trans*-2,5-Diphenyl-1,4-dioxanes"
J. Org. Chem., 33, 4558 (1968).
14. A. G. Hortmann, D. S. Daniel, and J. Schaefer
"Determination of the Configuration and Conformation of Gamma-Metasantonin"
J. Org. Chem., 33, 3988 (1968).
15. J. Schaefer, D. A. Bude, and R. J. Katnik
"Non-Markoffian Monomer Distributions in Copolymers.
The Copolymerization of Ethylene Oxide and Maleic Anhydride"
Macromolecules, 2, 289 (1969).
16. J. Schaefer
"Carbon-13 Nuclear Magnetic Resonance Analysis of Ethylene Oxide-Maleic Anhydride Copolymers"
Macromolecules, 2, 210 (1969).
17. J. Schaefer
"Carbon-13 Nuclear Magnetic Resonance Analysis of Poly(propylene oxide)" Macromolecules, 2, 533 (1969).
18. J. Schaefer and J. M. S. Henis
"Dependence of Ion-Molecule Reaction Cross Section on Internal Energy"
J. Chem. Phys., 51, 4671 (1969).
19. J. Schaefer and R. Yaris
"Random Matrix Theory and Nuclear Magnetic Resonance Spectral Distributions"
J. Chem. Phys., 51, 4469 (1969).
20. J. Schaefer
"High-Resolution Pulsed Carbon-13 NMR Analysis of Some Polyelectrolytes"
Macromolecules, 4, 98 (1971).
21. J. Schaefer
"High-Resolution Pulsed Carbon-13 NMR Analysis of Polyacrylonitrile"
Macromolecules, 4, 105 (1971).

22. J. Schaefer
"High-Resolution Pulsed Carbon-13 NMR Analysis of the Monomer Distribution in Styrene-Acrylonitrile Copolymers"
Macromolecules, 4, 107 (1971).
23. J. Schaefer
"High-Resolution Pulsed Carbon-13 NMR Analysis of Some Polymeric Gels"
Macromolecules, 4, 110 (1971).
24. J. C. Duggan, W. H. Urry, and J. Schaefer
"Carbon-13 Pseudo-Contact Shifts in Structure Determination: The Hemiketal Dimer from 2-Hydroxy-2-Methylcyclobutanone"
Tetrahedron Letters, 44, 4197 (1971).
25. J. Schaefer
"Selective Saturation of Carbon-13 Lines in Carbon-13 Fourier Transform NMR Experiments"
J. Mag. Res., 6, 670 (1972).
26. J. Schaefer and D. F. S. Natusch
"Carbon-13 Overhauser Effect in Polymer Solutions"
Macromolecules, 5, 416 (1972).
27. J. Schaefer
"Comparisons of the Carbon-13 Nuclear Magnetic Resonance Spectra of Some Solid *cis*- and *trans*-Polyisoprenes"
Macromolecules, 5, 427 (1972).
28. J. Schaefer
"Use of Noise-Modulated Partial Decoupling in the Interpretation of the Carbon-13 Nuclear Magnetic Resonance Spectra of Polymers"
Macromolecules, 5, 590 (1972).
29. J. Schaefer, S. H. Chin, and S. I. Weissman
"Magic-Angle Carbon-13 Nuclear Magnetic Resonance Spectra of Filled Rubber"
Macromolecules, 5, 798 (1972).
30. J. Schaefer
"Distributions of Correlation Times and the Carbon-13 Nuclear Magnetic Resonance Spectra of Polymers"
Macromolecules, 6, 882 (1973).
31. E. O. Stejskal and J. Schaefer
"Data Routing in Quadrature FT NMR"
J. Magn. Reson., 13, 249 (1974).

32. E. O. Stejskal and J. Schaefer
"Comparisons of Quadrature and Single-Phase Fourier Transfer NMR"
J. Magn. Reson., 14, 160 (1974).
33. J. Schaefer and E. O. Stejskal
"Baseline Artifacts in High-Resolution Fourier Transform NMR Spectra"
J. Magn. Reson., 15, 173 (1974).
34. J. Schaefer and E. O. Stejskal
"Carbon-13 Nuclear Magnetic Resonance Measurement of Oil Composition in Single Viable Soybeans"
J. Am. Oil. Chem. Soc., 51, 210 (1974).
35. J. Schaefer and E. O. Stejskal
"Determination of Oil, Starch, and Protein Content of Viable Intact Seeds by Carbon-13 Nuclear Magnetic Resonance"
J. Am. Oil. Chem. Soc., 51, 562 (1974).
36. E. O. Stejskal and J. Schaefer
"Carbon-13 Nuclear Magnetic Resonance Characterization of Heterogeneous Sequence Distributions in Styrene-Acrylonitrile Copolymers"
Macromolecules, 7, 14 (1974).
37. E. O. Stejskal and J. Schaefer
"Carbon-13 Nuclear Magnetic Resonance Study of the Separation of Styrene from Ethylbenzene by Dense Polymer Films"
Macromolecules, 7, 767 (1974).
38. E. O. Stejskal, J. Schaefer, J. M. S. Henis, and M. K. Tripodi
"Magic-Angle Carbon-13 NMR Study of CO₂ Adsorbed on Some Molecular Sieves"
J. Chem. Phys., 61, 2351 (1974).
39. J. Schaefer
"The Carbon-13 NMR Analysis of Synthetic High Polymers"
in *Topics in Carbon-13 NMR Spectroscopy*, (G.C. Levy, editor), John Wiley, 1974, p. 149.
40. J. Schaefer, E. O. Stejskal, and R. Buchdahl
"High-Resolution Carbon-13 Nuclear Magnetic Resonance Study of Some Solid Glassy Polymers"
Macromolecules, 8, 291 (1975).
41. E. O. Stejskal and J. Schaefer
"Removal of Artifacts From Cross-Polarization NMR Experiments"
J. Magn. Reson., 18, 560 (1975).

42. J. Schaefer and E. O. Stejskal
"Carbon-13 Nuclear Magnetic Resonance Analysis of Intact Oilseeds"
J. Am. Oil Chem. Soc., 52, 366 (1975).
43. J. Schaefer, E. O. Stejskal, and C. F. Beard
"Carbon-13 Nuclear Magnetic Resonance Analysis of Metabolism in Soybeans
Labeled by $^{13}\text{CO}_2$ "
Plant Physiol., 55, 1048 (1975).
44. J. Schaefer and E. O. Stejskal
**"Carbon-13 Nuclear Magnetic Resonance of Polymers Spinning
at the Magic Angle"**
J. Am. Chem. Soc., 98, 1031 (1976).
45. J. Schaefer
"The Analysis of ^{13}C NMR Relaxation Experiments in Polymers"
in *The Investigation of the Structure of Macromolecules by Spectroscopic Methods*, (K.J. Ivin,
editor), John Wiley, 1976, p. 201.
46. M. D. Sefcik, J. Schaefer, and E. O. Stejskal
"Characterization of the Mordenite Sorption Sites by Carbon-13 NMR"
in *Molecular Sieves II*, (J.R. Katzer, editor), American Chemical Society, 1977, p. 344.
47. E. O. Stejskal, J. Schaefer, and R. A. McKay
"High-Resolution, Slow-Spinning Magic-Angle Carbon-13 NMR"
J. Magn. Reson., 25, 569 (1977).
48. M. L. Rueppel, B. B. Brightwell, J. Schaefer, and J. T. Marvel
"Metabolism and Degradation of Glyphosate in Soil and Water"
Ag. Food Chem., 25, 517 (1977).
49. M. D. Sefcik, J. Schaefer, and E. O. Stejskal
"Characterization of the Small-Port Mordenite Adsorption
Sites by C-13 NMR"
ACS Symp. Series, 34, 109 (1977).
50. E. O. Stejskal, J. Schaefer, and J. S. Waugh
"Magic-Angle Spinning and Polarization Transfer in Proton-Enhanced NMR"
J. Magn. Reson., 28, 105 (1977).
51. J. Schaefer, E. O. Stejskal, and R. Buchdahl
"Magic-Angle ^{13}C NMR Analysis of Motion in Solid Glassy Polymers"
Macromolecules, 10, 384 (1977).
52. V. J. Bartuska, G. E. Maciel, J. Schaefer, and E. O. Stejskal
"Prospects for Carbon-13 Nuclear Magnetic Resonance Analysis
of Solid Fossil Fuel Materials"

- Fuel, 56, 354 (1977).
53. J. Schaefer, E. O. Stejskal, and R. Buchdahl
"Magic-Angle ^{13}C NMR Analysis of Motion in Solid Polycarbonate"
J. Macromol. Sci.-Phys., B13, 665 (1977).
 54. J. Schaefer, E. O. Stejskal, C. F. Brewer, H. D. Keiser,
and H. Sternlicht
"Cross Polarization ^{13}C Nuclear Magnetic Resonance Spectroscopy
of Collagen"
Arch. Biochem. Biophys., 190, 657 (1978).
 55. J. Schaefer
"High-Resolution C-13 NMR Studies of Solid Polymers"
in *Molecular Basis of Transitions and Relaxations*, (Dale J. Meier, editor), Midland
Macromolecular Monographs, Volume 4, Gordon and Breach Science Publishers, 1978, p. 103.
 56. T. R. Steger, E. O. Stejskal, R. A. McKay, B. Ray Stults, and J. Schaefer
"Magic-Angle C-13 NMR Conformational Analysis of
1,3,5-trimethoxybenzene"
Tetrahedron Letters, 295 (1979).
 57. J. Schaefer, E. O. Stejskal, and R. A. McKay
"Cross-Polarization NMR of N-15 Labeled Soybeans"
BBRC, 88, 274 (1979).
 58. J. Schaefer, R. A. McKay, and E. O. Stejskal
"Double-Cross Polarization NMR of Solids"
J. Magn. Reson., 34, 443 (1979).
 59. M. D. Sefcik, E. O. Stejskal, R. A. McKay, and J. Schaefer
"Investigation of the Structure of Acetylene-Terminated Polyimide
Resins Using Magic-Angle Carbon-13 Nuclear Magnetic Resonance"
Macromolecules, 12, 423 (1979).
 60. J. Schaefer and E. O. Stejskal
"High-Resolution ^{13}C NMR of Solid Polymers"
in *Topics in Carbon-13 NMR Spectroscopy*, Vol. 3 (G.C. Levy, editor), John Wiley, 1979, p. 283.
 61. T. R. Steger, J. Schaefer, E. O. Stejskal, R. A. McKay, and M. D. Sefcik
"High-Resolution Solid-State NMR of Glasses"
Ann. N.Y. Acad. Sci. 371, 106 (1981).
 62. E. O. Stejskal, J. Schaefer, and T. R. Steger
"High-Resolution ^{13}C Nuclear Magnetic Resonance in Solids"
Faraday Symp., 13, 56 (1979).

63. J. Schaefer, L. D. Kier, and E. O. Stejskal
**"Characterization of Photorespiration in Intact Leaves
Using ¹³C Carbon Dioxide Labeling"**
Plant Physiol., 65, 254 (1980).
64. J. Schaefer, E. O. Stejskal, T. R. Steger, M. D. Sefcik, and R. A. McKay
"Carbon-13 T_{1ρ} Experiments on Solid Glassy Polymers"
Macromolecules, 13, 1121 (1980).
65. T. R. Steger, J. Schaefer, E. O. Stejskal, and R. A. McKay
"Molecular Motion in Polycarbonate and Modified Polycarbonates"
Macromolecules, 13, 1127 (1980).
66. M. D. Sefcik, J. Schaefer, E. O. Stejskal, and R. A. McKay
"Analysis of the Room-Temperature Molecular Motions
of Poly(ethylene terephthalate)"
Macromolecules, 13, 1132 (1980).
67. G. S. Jacob, J. Schaefer, E. O. Stejskal, and R. A. McKay
"Magic-Angle N-15 NMR Study of Nitrate Metabolism of *Neurospora crassa*"
BBRC, 97, 1176 (1980).
68. J. Schaefer, M. D. Sefcik, E. O. Stejskal, and R. A. McKay
"Magic-Angle Carbon-13 NMR Analysis of the Interface Between Phases in a
Blend of Polystyrene with a Polystyrene-Polybutadiene Block Copolymer"
Macromolecules, 14, 188 (1981).
69. T. J. Sanford, R. D. Allendoerfer, E. T. Kang, P. Ehrlich, and J. Schaefer
"Magic-Angle C-13 NMR of Solid Polyphenylacetylenes"
J. Poly. Sci. Physics, 19, 1151 (1981).
70. J. Schaefer, E. O. Stejskal, M. D. Sefcik, and R. A. MacKay
"Applications of High Resolution C-13 and N-15 NMR of Solids"
Phil. Trans. R. Soc. Lond. A. 299, 593 (1981).
71. E. O. Stejskal, J. Schaefer, M. D. Sefcik, and R. A. McKay
"Magic-Angle C-13 NMR Study of the Compatibility of
Solid Polymeric Blends"
Macromolecules, 14, 275 (1981).
72. J. Schaefer, M. D. Sefcik, E. O. Stejskal, and R. A. McKay
"Separated Local Fields in Polymers by Magic-Angle C-13 NMR"
Macromolecules, 14, 280 (1981).
73. J. Schaefer, M. D. Sefcik, E. O. Stejskal, R. A. McKay, and P. L. Hall
"Characterization of the Catabolic Transformation of Lignin
in Culture Using Magic-Angle C-13 NMR"

- Macromolecules, 14, 557 (1981).
74. W. T. Dixon, J. Schaefer, M. D. Sefcik, E. O. Stejskal, and R. A. McKay
"Quantitative Chemical Composition of Materials Such as Humic Soils,
Lignins, and Coals by High-Resolution C-13 NMR"
J. Magn. Reson., 45, 173 (1981).
 75. J. Schaefer, T. A. Skokut, E. O. Stejskal, R. A. McKay, and J. E. Varner
"Estimation of Protein Turnover Using Magic Angle Double Cross
Polarization N-15 NMR"
J. Biol. Chem., 256, 11574 (1981).
 76. J. Schaefer, T. A. Skokut, E. O. Stejskal, R. A. McKay, and J. E. Varner
"Asparagine Amide Metabolism in Developing Cotyledons of Soybean"
Proc. Natl. Acad. Sci. USA, 78, 5978 (1981).
 77. L. C. Damude, P. A. W. Dean, M. D. Sefcik, and J. Schaefer
"The Solid State Structure of Arene-Mercury(II) Complexes from
Magic-Angle Spinning C-13 NMR"
J. Organomet. Chem., 226, (1982).
 78. T. A. Skokut, J. E. Varner, J. Schaefer, E. O. Stejskal, and R. A. McKay
"N-15 NMR Determination of Asparagine and Glutamine
Nitrogen Utilization for Synthesis of Storage
Protein in Developing Cotyledons of Soybean in Culture"
Plant. Physiol., 69, 308 (1982).
 79. T. A. Skokut, J. E. Varner, J. Schaefer, E. O. Stejskal, and R. A. McKay
"N-15 and C-13 NMR Determination of Utilization of Glycine in
Developing Cotyledons of Soybean"
Plant Physiol., 69, 314 (1982).
 80. E. O. Stejskal, J. Schaefer, M.D. Sefcik, G. S. Jacob, and R. A. McKay
"Magic-Angle NMR Studies of Polymers"
Pure and Applied Chem., 54, 461 (1982).
 81. J. Schaefer, E. O. Stejskal, G. S. Jacob, and R. A. McKay
"Natural Abundance N-15 NMR Study of the Solids from the
Reaction of HCN and Ammonia"
Applied Spec., 36, 179 (1982).
 82. J. Schaefer, E. O. Stejskal, and R. A. McKay
"Chemical Bond Labeling and Double Cross-Polarization NMR"
ACS Symp. Series, 191, 187 (1982).
 83. W. T. Dixon, J. Schaefer, M. D. Sefcik, E. O. Stejskal, and R. A. McKay
"Total Suppression of Sidebands in CPMAS C-13 NMR"

- J. Magn. Reson., 49, 341 (1982).
84. J. Schaefer, R. A. McKay, E. O. Stejskal, and W. T. Dixon
"Dipolar Rotational Spin-Echo ^{13}C NMR of Polymers"
J. Magn. Reson. 52, 123 (1983).
85. M. D. Sefcik, J. Schaefer, E. O. Stejskal, R. A. McKay, J. F. Ellena, S. W. Dodd, and M. F. Brown
"Lipid Bilayer Dynamics and Rhodopsin-Lipid Interactions"
BBRC 114, 1048 (1983).
86. M. D. Sefcik, J. Schaefer, F. L. May, D. Raucher, and S. M. Dub
"Diffusivity of Gases and Main-Chain Cooperative Motions in
Plasticized Poly(vinyl Chloride)"
J. Poly. Sci. Physics 21, 1041 (1983).
87. M. D. Sefcik and J. Schaefer
"Solid-State ^{13}C NMR Evidence for Gas-Polymer Interactions in the
Carbon Dioxide-Poly(vinyl Chloride) System"
J. Poly. Sci. Physics 21, 1055 (1983).
88. G. S. Jacob, J. Schaefer, and G. E. Wilson, Jr.
"Direct Measurement of Peptidoglycan Cross-linking in
Bacteria by ^{15}N NMR"
J. Biol. Chem., 258, 10824 (1983).
89. J. Schaefer, M. D. Sefcik, E. O. Stejskal, R. A. McKay, W. T. Dixon and R. E. Cais
"Molecular Motion in Glassy Polystyrenes"
ACS Symp. 247, 43 (1984).
90. J. Schaefer, E. O. Stejskal, R. A. McKay, and W. T. Dixon
"Phenylalanine Ring Dynamics by Solid-State ^{13}C NMR"
J. Magn. Reson. 57, 85 (1984).
91. J. Schaefer, M. D. Sefcik, E. O. Stejskal, R. A. McKay, W. T. Dixon and R. E. Cais
"Molecular Motion in Glassy Polystyrenes"
Macromolecules 17, 1107 (1984).
92. J. Schaefer, M. D. Sefcik, E. O. Stejskal, and R. A. McKay
"Carbon-13 $T_{1\rho}$ Experiments on Solid Polymers Having Tightly
Spin-Coupled Protons"
Macromolecules 17, 1118 (1984).
93. R. A. McKay, J. Schaefer, E. O. Stejskal, R. Ludicky, and C. N. Matthews
"Double-Cross Polarization Detection of Labeled Chemical Bonds
in HCN Polymerization"
Macromolecules 17, 1124 (1984).

94. E. O. Stejskal, J. Schaefer, and R. A. McKay
"Analysis of Double-Cross Polarization Rates in Solid Proteins"
J. Magn. Reson. 57, 471 (1984).
95. J. Schaefer, E. O. Stejskal, J. R. Garbow, and R. A. McKay
"Quantitative Determination of the Concentrations
of ^{13}C - ^{15}N Chemical Bonds by Double Cross-Polarization NMR"
J. Magn. Reson. 59, 150 (1984).
96. J. Schaefer, E. O. Stejskal, R. A. McKay, and W. T. Dixon
"Molecular Motion in Polycarbonates by Dipolar Rotational
Spin-Echo ^{13}C NMR"
Macromolecules 17, 1479 (1984).
97. C. N. Matthews, R. Ludicky, J. Schaefer, E. O. Stejskal, and R. A. McKay
"Heteropolypeptide From Hydrogen Cyanide and Water?
Solid State ^{15}N NMR Investigations"
Origins of Life 14, 243 (1984).
98. J. Skolnick, D. Perchak, R. Yaris, and J. Schaefer
"Phenomenological Model of the Stress-Strain Behavior of
Glassy Polymers"
Macromolecules 17, 2332 (1984).
99. G. E. Wilson, Jr., G. S. Jacob, and J. Schaefer
"Solid-State N-15 NMR Studies of the Effects of
Penicillin on Cell-Wall Metabolism of *Aerococcus viridans*"
BBRC, 126, 1006 (1985).
100. G. T. Coker and J. Schaefer
"N-15 and C-13 NMR Determination of Allantoin Metabolism
in Developing Soybean Cotyledons"
Plant Physiol. 77, 129 (1985).
101. G. S. Jacob, J. Schaefer, and G.E. Wilson, Jr.
"Solid-State C-13 and N-15 NMR Studies of Alanine Metabolism
in *Aerococcus viridans*"
J. Biol. Chem. 260, 2777 (1985).
102. J. Schaefer, E. O. Stejskal, D. Perchak, J. Skolnick, and R. Yaris
"Molecular Mechanism of the Ring-Flip Process in Polycarbonate"
Macromolecules 18, 368 (1985).
103. J. Mason, D. M. P. Mingos, J. Schaefer, D. Sherman, and E. O. Stejskal
"N-15 NMR Characterization of Bent and Linear Nitrosyl Ligands in the
Solid State by Cross-polarization Magic-angle-spinning Spectroscopy of
Complexes of Ruthenium"

- J. Chem. Soc., Chem. Commun. 444 (1985).
104. G. S. Jacob, J. Schaefer, E. O. Stejskal and R. A. McKay
"Solid-State NMR Determination of Glyphosate Metabolism in
a *Pseudomonas sp.*"
J. Biol. Chem., 260, 5899 (1985).
105. J. Schaefer
"Characterization of Solid Polymers by Carbon-13 NMR"
in *New Direction in Chemical Analysis*, (B.L. Shapiro, editor),
Texas A & M University Press, 1985, p. 396.
106. T. A. Skokut, J. Manchester and J. Schaefer
"Stimulation of Somatic Embryo Production by Amino Acids
and N-15 NMR Determination of Nitrogen Utilization"
Plant Physiol., 79, 579 (1985).
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"Characterization of Intracellular pH During Somatic
Embryo Production by Solid-State P-31 NMR"
Plant Physiol., 79, 584 (1985).
108. J. Schaefer, J. R. Garbow, G. S. Jacob, T. M. Forrest
and G. E. Wilson, Jr.
"Characterization of Peptidoglycan Stem Lengths by
Solid-State ¹³C and ¹⁵N NMR"
BBRC, 137, 736 (1986).
109. T. Fukamizo, K. J. Kramer, D. D. Mueller, J. Schaefer, J. R. Garbow
and G. S. Jacob
"Analysis of Chitin Structure by NMR Spectroscopy and
Chitinolytic Enzyme Digestion"
Arch. Biochem. Biophys., 249, 15 (1986).
110. G. S. Jacob, J. R. Garbow, and J. Schaefer
"Direct Measurement of Poly(β -Hydroxybutyrate) in
a Pseudomonad by Solid-State ¹³C NMR"
J. Biol. Chem., 261, 16785 (1986).
111. J. R. Garbow, J. Schaefer, R. Ludicky, and C. N. Matthews
"Detection of Secondary Amides in HCN Polymers by
Dipolar Rotational Spin-Echo N-15 NMR"
Macromolecules, 20, 305 (1987).
112. J. R. Garbow and J. Schaefer
"The Effect of Annealing on the Main-Chain Motions of
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