

Department of Biochemistry
Albert Einstein College of Medicine, Bronx, NY 10461
718-430-3024 (Voice) 718-430-8565 (Fax) robert.callender@einstein.yu.edu

PUBLICATIONS

Invited Reviews

- "Resonance Raman Studies of Visual Pigments", R. H. Callender and B. Honig, *Annual Review of Biophysics and Bioengineering* **6**, 33 (1977).
- "Resonance Raman Techniques for Photolabile Samples: Pump-Probe and Flow", R. Callender, in *Visual Pigments and Purple Membranes*, *Methods of Enzymology* (eds. Colowick, Kaplan, and L. Packard), Academic Press, 1982.
- "An Introduction to Visual Pigments and Purple Membranes and their Primary Processes", R. Callender, in *Primary Events in Biology Investigated by Ultrafast Laser Spectroscopy*, ed. R. Alfano (Academic Press, New York 1982).
- "Ultrafast Photophysical Processes in Visual Pigments", in *Fluorescence in the Biological Sciences*, eds. D. L. Taylor, A. S. Waggoner, F. Lanni, R. F. Murphy, and R. Birge (Alan R. Liss, New York, 1986) pp. 69-89.
- "The First Picosecond in Vision", in *Cell Structure and Function by Microspectrofluorometry*, R. H. Callender, eds. Elli Kohen and Joseph Hirschberg (Academic Press, New York, 1989), pp. 185-198.
- "Enzymatic Catalysis and Molecular Recognition: The Energetics of Ligand Binding to Proteins as Studied by Vibrational Spectroscopy", H. Deng and R. H. Callender, *Comments on Molecular and Cellular Biophysics* **8**, 137 (1993).
- "Non-Resonance Raman Difference Spectroscopy: A General Probe Of Protein Structure, Ligand Binding, Enzymatic Catalysis, and the Structures Of Other Biomacromolecules", Robert Callender and Hua Deng, *Ann. Rev. of Biophysics and Biomolecular Structure* **23**, 215 (1994).
- "Protein Physics", Robert Callender, Rudolf Gilmanishin, Brian Dyer, and William Woodruff, in *Physics World*, ed. Philip Campbell (Techno House, Bristol, UK), Vol. 7 (August Issue), pp.41-45 (1994).
- "Raman Difference Studies of Protein Structure and Folding, Enzymatic Catalysis, and Ligand Binding," Robert Callender, Hua Deng, and Rudolf Gilmanishin, *J. Raman Spectroscopy* **29**, 15-21(1998).
- "The Primary Processes of Protein Folding", Robert Callender, Rudolf Gilmanishin, Brian Dyer, and Woody Woodruff, *Annual Reviews of Physical Chemistry* **49**, 173-202 (1998).
- "Infrared Studies of Fast Events in Protein Folding", R. Brian Dyer, Feng Gai, William H. Woodruff, Rudolf Gilmanishin, and Robert Callender, *Accs. Chem. Res.* **31**, 709-716 (1998).
- "Raman Observations of Bound Substrate Structure and Distortion", Robert Callender and Hua Deng, in *Methods in Enzymology* **308**, 'Energetics of Enzymic Processes', part E of 'Enzyme Kinetics and Mechanism', 176-200 (1999).
- "Raman Difference Studies of Protein-Nucleic Acid Interactions", Hua Deng and Robert Callender, *J. Raman Spectroscopy* **30**, 685-691 (1999).
- "Vibrational Studies of Enzymatic Catalysis", Hua Deng and Robert Callender, in *Infrared and Raman Spectroscopy of Biological Materials*, eds. Hans-Ulrich Gremlich and Bing Yan, (Marcel Dekker, Inc., New York, pp.1-581), pp. 477-515 (2001).
- "Probing Protein Dynamics Using Temperature Jump Relaxation Spectroscopy", Robert Callender, and R. Brian Dyer, *Current Opinion in Structural Biology* **12**, 628-633 (2002).

- "Time-Resolved Approaches to Characterize the Dynamical Nature of Enzyme Catalysis", Robert Callender and R. Brian Dyer, *Chemical Reviews* 106, 3031-3042 (2006).
- "Spectroscopic Probes of Hydride-Transfer Activation by Enzymes", *Hydrogen-Transfer Reactions, Vol. 4 (Biological Aspects of Hydrogen Transfer III-IV)*, J. T. Hynes, J. P. Klinman, H.-H. Limbach, and R.L. Schowen, eds. (Wiley VCH, Weinheim), 2007, pp. 1393-1415.
- "Protein Dynamics: Time Resolved Studies", Callender, R. and R.B. Dyer, , in *Encyclopedia of Biophysics*, M. Deshpande, Editor, Springer-Verlag: Berlin. p. 2007-2014 (2013).
- "Isotope Edited Raman and Infrared Difference Spectroscopy", Deng, H. and R. Callender, in *Encyclopedia of Biophysics*, M. Deshpande, Editor, Springer-Verlag: Berlin. p. in press (2013).
- "The Dynamical Nature of Enzymatic Catalysis", Robert Callender and R. Brian Dyer, *Accounts of Chemical Research* 48, 407-413 (2015). PMC4333057.

Peer Reviewed Articles (151 articles)

- "The Response of High Altitude Ionization Chambers During 1954-1966 Solar Cycle", R. H. Callender, J. R. Manzano, and J. R. Winckler, *J. Geophysical. Res.* 70, 3189 (1965).
- "Molecular Rotations and Kinetics by Light Scattering", R. H. Callender and P. S. Pershan, *Phys. Rev. Letters* 23, 947 (1969).
- "Rotational Raman Effect: Molecular Impurities in Alkali Halides", R. H. Callender, and P. S. Pershan, *Phys. Rev.* A2 672 (1970).
- "Dispersion of the Raman Cross Section in CdS and ZnO over a Wide Energy Range", R. H. Callender, S. S. Sussman, M. Selders, and R. K. Chang, *Phys. Rev.* B7, 3788 (1973).
- "Wavelength and Concentration Dependence of Raman Scattering from $\text{CdS}_{1-x}\text{Se}_x$ ", S. S. Sussman, R. Alben, M. Selders, R. K. Chang, and R. H. Callender, *Solid State Communications* 13, 799 (1973).
- "Resonant Raman Effect of I_2 Dissolved in Solution", R. Fenstermacher and R. H. Callender, *Optics Communications* 10, 181 (1974).
- "Dependence of Transition Moment on Internuclear Separation in Na_2 ", R. H. Callender, J. I. Gersten, R. W. Leigh and J. L. Yang, *Phys. Rev. Letters* 32, 917 (1974).
- "Resonant Raman Spectroscopy from Rhodopsin in Retinal Disk Membranes", A. R. Oseroff and R. H. Callender, *Biochemistry* 13, 4243 (1974).
- "Role of Metastable Dimers in the Theory of Induced Atomic Fluorescence", R. H. Callender, J. I. Gersten, R. W. Leigh and J. L. Yang, *Phys. Rev. Letters* 33, 1311 (1974).
- "Molecular Flow Resonance Raman Effect from Retinal and Rhodopsin", R. H. Callender, A. G. Doukas, R. Crouch, and K. Nakanishi, *Biochemistry* 15, 1621 (1976).
- "Laser-Induced Atomic Fluorescence from Na", R. H. Callender, J. I. Gersten, R. W. Leigh, and J. L. Yang, *Phys. Rev.* A14, 1672 (1976).
- "Resonance Raman Studies of the Purple Membrane", B. Aton, A. G. Doukas, R. H. Callender, B. Becher, and T. Ebrey, *Biochemistry* 16, 2995 (1977).
- "Cis-Trans Isomerization of Rhodopsin Occurs in Picoseconds", B. Green, T. Monger, R. R. Alfano, B. Aton, R. H. Callender, *Nature* 269, 179 (1977).
- "Deflection of Laser-excited Atoms by an Electric Field", M. Mittleman, K. Rubin, R. Callender, and J. Gersten, *Phys. Rev.* A16, 583 (1977).
- "Resonance Raman Studies of Bovine Metarhodopsin I and Metarhodopsin II", A. G. Doukas, B. Aton, R. H. Callender, and T. Ebrey, *Biochemistry* 17, 2430 (1978).
- "Resonance Raman Excitation Profiles of All Trans Retinal: Theoretical Implications", A. G. Doukas, B. Aton, R. H. Callender, and B. Honig, *Chem. Phys. Letts.* 56, 248 (1978).
- "Photochemical Cis-Trans Isomerization of Bovine Rhodopsin at Liquid Helium Temperatures", B. Aton, R. H. Callender and B. Honig, *Nature* 273, 784 (1978).

- "Photoisomerization, Energy Storage, and Salt Bridge Cleavage: A Model for the Energy Transduction in Visual Pigments and Bacteriorhodopsin", B. Honig, T. Ebrey, R. H. Callender, U. Dinur, and M. Ottolenghi, *Proc. Natl. Acad. Sci. (USA)* **76**, 2503 (1979).
- "Resonance Raman Studies of Dark Adapted Purple Membrane", B. Aton, A. G. Doukas, R. H. Callender, B. Becher, and T. Ebrey, *B.B.A.* **576**, 424 (1979).
- "The Photochemistry of Rhodopsin and Isorhodopsin Investigated on a Picosecond Time Scale", T. Monger, R. R. Alfano, and R. H. Callender, *Biophysical J.* **27**, 105 (1979).
- "Resonance Raman Studies of the Primary Photochemical Event in Visual Pigments", B. Aton, A. G. Doukas, D. Narva, R. Callender, U. Dinur and B. Honig, *Biophysical J.* **29**, 79 (1980).
- "On the State of Chromophore Protonation in Rhodopsin: Implication for Primary Photochemistry in Visual Pigments", D. Narva and R. H. Callender, *Photochem. Photobiol.* **32**, 273 (1980).
- "Squid Bathorhodopsin Forms within Ten Picoseconds", A. G. Doukas, V. Stefancic, T. Suzuki, R. Callender, and R. R. Alfano, *Photobiochem. Photobiophys.* **1**, 305 (1980).
- "Primary Photochemistry and Photoisomerization of Retinal at 77 K in Cattle and Squid Rhodopsins", T. Suzuki and R. Callender, *Biophysical J.* **34**, 261 (1981).
- "Low Temperature Resonance Raman Study of the L Intermediate of Bacteriorhodopsin", D. Narva, R. Callender, and T. Ebrey, *Photochem. Photobiol.* **33**, 567 (1981).
- "On the Mechanism of Hydrogen-Deuteron Exchange in Bacteriorhodopsin", A. G. Doukas, A. Pande, T. Suzuki, R. Callender, B. Honig, and M. Ottolenghi, *Biophysical J.* **33**, 275 (1981).
- "Resonance Raman Study of the Primary Photochemistry of Bacteriorhodopsin", J. Pande, R. H. Callender and T. G. Ebrey, *Proc. Natl. Acad. Sciences (USA)* **78**, 7379 (1981).
- "Acid-Base Equilibrium of the Schiff Base in Bacteriorhodopsin", S. Druckmann, M. Ottolenghi, A. Pande, J. Pande, and R. Callender, *Biochemistry* **21**, 4953 (1982).
- "On the Chromophore Configuration of Metarhodopsin II", J. Pande, A. Pande, R. H. Callender, *Photochem. Photobiol.* **36**, 107 (1982).
- "On the Correlation of Vibrational Frequencies with Absorption Maxima in Polyenes, Rhodopsin, Bacteriorhodopsin, and Retinal Analogs", H. Kakitani, T. Kakitani, H. Rodman, B. Honig, and R. H. Callender, *J. Physical Chemistry* **87**, 3620 (1983).
- "Picosecond Kinetic Absorption and Fluorescence Studies of Bovine Rhodopsin with a Fixed 11-ene", J. Buchert, V. Stefancic, A. G. Doukas, R. R. Alfano, R. H. Callender, J. Pande, H. Akita, V. Balogh-Nair, and K. Nakanishi, *Biophysical J.* **43**, 279 (1983).
- "Picosecond Fluorescence Relaxation Kinetics from All-Trans Retinal", A. G. Doukas, M. R. Junnarkar, D. Chandra, R. R. Alfano, and R. H. Callender, *Chemical Physics Letters* **100**, 420 (1983).
- "Resonance Raman Study of the Primary Photochemistry of Visual Pigments: Hypsorhodopsin", A. Pande, R. H. Callender, T. G. Ebrey, and M. Tsuda, *Biophysical J.* **45**, 573-576 (1984).
- "Fluorescence Quantum Yield of Visual Pigments: Evidence for Subpicosecond Isomerization Rates", A. G. Doukas, M. R. Junnarkar, R. R. Alfano, R. H. Callender, T. Kakitani, and B. Honig, *Proc. Natl. Acad. Sci. (USA)* **81**, 4790 (1984).
- "Spectroscopic Characterization of Nitrated Purple Membranes", E. Lam, A. Pande, R. H. Callender, E. F. Hilinski, P. M. Rentzepis, and L. Packer, *Biochemistry International* **8**, 217 (1984).
- "Raman Spectroscopy of Liver Alcohol Dehydrogenase", K. T. Yue, J.-P. Yang, C. L. Martin, D. L. Sloan, and R. H. Callender, *Biochemical and Biophysical Research Communications* **122**, 225 (1984).
- "A Raman Study of Reduced Nicotinamide Adenine Dinucleotide Bound to Liver Alcohol Dehydrogenase", K. T. Yue, J.-P. Yang, C. L. Martin, S. K. Lee, D. L. Sloan, and R. H. Callender, *Biochemistry* **23**, 6480 (1984).

- "Neither the Retinal Ring nor the Ring Double Bond is Required for Proton Pumping in Bacteriorhodopsin", R. K. Crouch, Y. S. Or, S. Ghent, C.-H. Chang, R. Govindjee, T. G. Ebrey, R. H. Callender, and A. Pande, *J. Am. Chem. Soc.* **106**, 8325 (1984).
- "The Primary Event in Vision Investigated by Time-Resolved Fluorescence Spectroscopy", A. G. Doukas, M. R. Junnarkar, R. R. Alfano, R. H. Callender, and V. Balogh-Nair, *Biophysical J.* **47**, 795 (1985).
- "Resonance Raman Studies of Bacteriorhodopsin Analogues", R. Schiffmiller, R. H. Callender, W. Waddell, R. Govindjee, T. G. Ebrey, H. Kakitani, B. Honig, and K. Nakanishi, *Photochem. Photobiol.* **41**, 563 (1985).
- "A Detailed Resonance Raman Study of the M412 Intermediate in the Bacteriorhodopsin Photocycle", H. Deng, C. Pande, R. H. Callender, and T. G. Ebrey, *Photochem. Photobiol.* **41**, 467 (1985).
- "A Resonance Raman and Infrared Study of Cyanine Dyes", J.-P. Yang and R. H. Callender, *J. Raman Spectroscopy* **16**, 319 (1985).
- "Resonance Raman Spectra of the "Blue" and the Regenerated "Purple" Membranes of *Halobacterium Halobium*", C. Pande, C.-H. Chang, T. G. Ebrey, and R. H. Callender, *Photochem. Photobiol.* **42**, 545 (1985).
- "Raman Spectroscopy of Oxidized and Reduced Nicotinamide Adenine Dinucleotides", K. T. Yue, C. L. Martin, D. Chen, P. Nelson, D. L. Sloan, and R. H. Callender, *Biochemistry*, **25**, 4941 (1986).
- "Resonance Raman Spectroscopy of the Pink Membrane Prepared from the Deionized Blue Membrane of *Halobacterium halobium*", C. Pande, R. H. Callender, C.-H. Chang, and T. G. Ebrey, *Biophysical J.* **50**, 545 (1986).
- "5-Trifluoromethyl Bacteriorhodopsin Does Not Translocate Protons", V. J. Rao, F. Derguini, K. Nakanishi, T. Taguchi, A. Nosoda, Y. Hanzawa, Y. Kobayashi, C. Pande, and R. H. Callender, *J. Am. Chem. Soc.* **108**, 6077 (1986).
- "Raman, I.R., and C.D. Spectroscopic Studies on Metallothionein - A Predominantly 'Turn' Containing Protein", J. Pande, C. Pande, D. Gilg, M. Vasak, R. H. Callender, and J. H. R. Kagi, *Biochemistry* **25**, 5526 (1986).
- "Resonance Raman Spectroscopy of Octopus Rhodopsin and its Photoproducts", C. Pande, A. Pande, K. T. Yue, R. H. Callender, T. G. Ebrey, and M. Tsuda, *Biochemistry* **26**, 4941 (1987).
- "Classical Raman Spectroscopic Studies of NADH and NAD⁺ Bound to Liver Alcohol Dehydrogenase by Difference Techniques", D. Chen, K. T. Yue, C. Martin, K. W. Rhee, D. L. Sloan, and R. H. Callender, *Biochemistry* **26**, 4776 (1987).
- "Quantum Efficiencies of Primary Photochemical Processes in Vertebrate Rhodopsin", R. Birge and R. H. Callender in *Biophysical Studies of Retinal Proteins*, eds. T. G. Ebrey, B. Honig, H. Fraunfelder, & K. Nakanishi, (University of Illinois Press, 1987), pp. 270-281.
- "A Study of the Schiff Base Mode in Rhodopsin and Bathorhodopsin", H. Deng and R. H. Callender, *Biochemistry* **26**, 7418 (1987).
- "Resonance Raman Spectroscopy of the U. V. Sensitive *Ascalaphus* Rhodopsin", C. Pande, H. Deng, P. Rath, R. H. Callender, and J. Schwemer, *Biochemistry* **26**, 7426 (1987).
- "The Molecular Properties of p-Dimethylamino Benzaldehyde Bound to Liver Alcohol Dehydrogenase: a Raman Spectroscopic Study", R. H. Callender, D. Chen, J. Lugtenburg, C. Martin, K. W. Rhee, D. L. Sloan, R. VanderSteen, and K. T. Yue, *Biochemistry* **27**, 3672 (1988).
- "Effect of Lipid Protein Interaction on the Color of Bacteriorhodopsin", C. Pande, R. H. Callender, J. Baribeau, and F. Boucher, & A. Pande, *Biochim. Biophys. Acta.* **973**, 257 (1989).
- "Classical Difference Raman Spectroscopic Studies of NADH and NAD⁺ Bound to Lactate Dehydrogenase by Difference Techniques", H. Deng, J. Zheng, J. Burgner, D. Sloan, & R. H. Callender, *Biochemistry* **28**, 1525 (1989).
- "Effects of Various Anions on the Raman Spectrum of Halorhodopsin", C. Pande, J. Lanyi, & R. H. Callender, *Biophysical J.* **55**, 425 (1989).

- "Hydrogen Bonding and Reaction Specificity in Lactate Dehydrogenase Studied by Raman Spectroscopy", H. Deng, J. Zheng, D. Sloan, J. Burgner, & R. H. Callender, *J. Physical Chemistry* 93, 4710 (1989).
- "Raman Spectroscopic Evidence for a Disulfide Bridge in Calf γ II Crystallin", J. Pande, M. J. McDermott, R. H. Callender, & Abraham Spector, *Archives of Biochemistry and Biophysical* 269, 250 (1989).
- "Raman Difference Spectroscopy in Measurements of Molecules and Molecular Groups inside Proteins", K. T. Yue, H. Deng, R. H. Callender, *J. of Raman Spectroscopy* 20, 541 (1989).
- "Molecular Properties of Pyruvate Bound to Lactate Dehydrogenase: A Raman Spectroscopic Study", H. Deng, J. Zheng, J. Burgner, & R. H. Callender, *Proc. Natl. Acad. Sci. (USA)* 86, 4484 (1989).
- "Purple Membrane - Color, Crystallinity, and the Effect of DMSO", C. Pande, R. H. Callender, R. Henderson, and A. Pande, *Biochemistry* 28, 5971 (1989).
- "Laser-Induced Binding of Precured Rubber Compounds", P. L. Baldeck, S. Y. Yang, R. R. Alfano, R. H. Callender, C. Bennet, and W. H. Waddel, *Optical Engineering* 30, 312 (1991).
- "The Calf Gamma Crystallins - A Raman Spectroscopic Study", J. Pande, M. McDermott, R. H. Callender, and A. Spector, *Experimental Eye Research* 52, 193 (1991).
- "The Determination of the pKa of Histidine Residues in Proteins by Raman Difference Spectroscopy", K. T. Yue, M. Lee, J. Zheng, and R. H. Callender, *Biochim. Biophys. Acta.* 1078, 296 (1991).
- "Resonance Raman Studies of the HOOP Modes in Octopus Bathorhodopsin with Deuterium Labelled Retinal Chromophores", H. Deng, D. Manor, G. Weng, P. Rath, Y. Koutalos, T. Ebrey, R. Gebhard, J. Lugtenburg, M. Tsuda, and R. H. Callender, *Biochemistry* 30, 4495 (1991).
- "Raman Spectroscopic Studies of NAD Coenzymes Bound to Malate Dehydrogenases by Difference Techniques", H. Deng, J. Burgner, and R. H. Callender, *Biochemistry* 30, 8804 (1991).
- "A Resonance Raman Study of Octopus Bathorhodopsin with Deuterium Labelled Chromophores", H. Deng, D. Manor, G. Weng, P. Rath, Y. Koutalos, T. Ebrey, R. Gebhard, J. Lugtenburg, M. Tsuda, and R. H. Callender, *Photochemistry Photobiology* 54, 1001 (1991).
- "Ultra-Fast Spectroscopy of the Visual Pigment Rhodopsin", M. Yan, D. Manor, G. Weng, H. Chao, L. Rothberg, T.M. Jedju, R. R. Alfano, and R. H. Callender, *Proc. Natl. Acad. Sci. (USA)* 88, 9809 (1991).
- "An Isotope Edited Classical Raman Difference Spectroscopic Study of the Interactions of Guanine Nucleotides With Elongation Factor Tu and H-ras p21", D. Manor, G. Weng, H. Deng, S. Cosloy, C.-X. Chen, V. Balogh-Nair, K. Delaria, F. Jurnak, and R. H. Callender, *Biochemistry* 30, 10914 (1991).
- "A Vibrational Analysis of the Catalytically Important C4-H Bonds of NADH Bound to Lactate or Malate Dehydrogenase: Ground State Effects", Hua Deng, Jie Zheng, Donald Sloan, John Burgner, and Robert Callender, *Biochemistry* 31, 5085 (1992).
- "Raman Spectroscopic Studies of the Effects of Substrate Binding on Coenzymes Bound to Lactate Dehydrogenase", Hua Deng, John Burgner, and Robert Callender, *J. Am. Chem. Soc.* 114, 7997 (1992).
- "The Interactions of Retinoids With Retinal Binding Protein: A Resonance Raman Spectroscopic Study", Danny Manor, Robert Callender, and Noa Noy, *Eur. J. Biochemistry* 213, 413 (1993).
- "Structure of the Complex Between Pyridoxal 5'-Phosphate and the Tyrosine-225 to Phenylalanine Mutant of *Escherichia Coli* Aspartate Aminotransferase Determined by Isotope Edited Classical Raman Difference Spectroscopy", Jonathan Goldberg, Jie Zheng, Hua Deng, Yong Q. Chen, Robert Callender, and Jack Kirsch, *Biochemistry* 32, 8092 (1993).

- "A Study of the Binding of NADP Coenzymes to Dihydrofolate Reductase by Raman Difference Spectroscopy", Jie Zheng, Yong Q. Chen, and Robert Callender, *European Journal of Biochemistry* **215**, 9 (1993).
- "Elucidation of the Solution Structure of the *Escherichia Coli* α -Methyl-L-Aspartate-Aminotransferase Complex by Isotope Edited Raman Difference Spectroscopy", Hua Deng, Jonathan M. Goldberg, Jack F. Kirsch, and Robert Callender, *J. Am. Chem. Soc.* **115**, 8869 (1993).
- "Characterization of trans and cis 5-methylthienylacryloyl-chymotrypsin using Raman difference spectroscopy, NMR and kinetics: Carbonyl environment and reactivity", P. J. Tonge, P. R. Carey, R. H. Callender, H. Deng, I. Ekiel, and R. Muhandiram, *J. Am. Chem. Soc.* **115**, 8757 (1993).
- "Internal Chemical Bonding in Solution of Simple Phosphates and Vanadates", W. J. Ray, John W. Burgner, Hua Deng, and Robert Callender, *Biochemistry* **32**, 12977 (1993).
- "A Comparison of Vibrational Frequencies of Critical Bonds in Ground State Complexes and in a Vanadate-Based Transition State Complex of Muscle Phosphoglucosmutase. Mechanistic Implications", Hua Deng, William Ray, John Burgner, and Robert Callender, *Biochemistry* **32**, 12984 (1993).
- "The Hydrogen Bond Interactions of G Proteins with the Guanine Ring Moiety of Guanine Nucleotides", Gezhi Weng, Danny Manor, Zhenjia Chen, Valeria Balogh-Nair, and Robert Callender, *Protein Science* **3**, 22 (1994).
- "Source of Catalysis in the Lactate Dehydrogenase System: Ground State Interactions in the Enzyme•Substrate Complex", Hua Deng, Jie Zheng, Anthony Clarke, John Holbrook, Robert Callender, and John Burgner, *Biochemistry* **33**, 2297 (1994).
- "Evidence For a Bound Water Molecule Next to the Retinal Schiff Base in Bacteriorhodopsin and Rhodopsin: A Resonance Raman Study Of the Schiff Base Hydrogen/Deuteron Exchange", Hua Deng, Liewen Huang, Tom Ebrey and Robert Callender, *Biophysical J.* **66**, 1129 (1994).
- "Vibrational Analysis of a Retinal Protonated Schiff Base Analog", H. Deng, L. Huang, M. Groesbeek, J. Lugtenburg, and R. H. Callender, *J. Phys. Chem.* **98**, 4776 (1994).
- "Raman Difference Spectroscopic Determination of the pKa of N5 of Dihydrofolate's Bound To Dihydrofolate Reductase: Mechanistic Implications". Yong Q. Chen, Joseph Kraut, Raymond L. Blakley, and Robert Callender, *Biochemistry* **33**, 7021 (1994).
- "Fast Events in Protein Folding: Helix Melting and Formation in a Small Peptide", Skip Williams, Timothy Causgrove, Rudolf Gilmanshin, Karen Fang, Robert Callender, William Woodruff, and R. Brian Dyer, *Biochemistry* **35**, 691 (1996).
- "Low-Frequency Light Scattering Spectroscopy of Powders", Joel Hernandez, Gen Li, Herman Z. Cummins, and Robert H. Callender, *J. Optical Society of America B* **13**, 1130 (1996).
- "Trypanosomal Nucleoside Hydrolase. Resonance Raman Spectroscopy of a Transition-State Inhibitor Complex", Hua Deng, Anita W.-Y. Chan, Carey K. Bagdassarian, Bernardo Estupinan, Bruce Ganem, Robert Callender, and Vern Schramm, *Biochemistry* **35**, 6037 (1996).
- "Study of the Ribonuclease S-peptide/S-Protein Complex by Means of Raman Difference Spectroscopy", Rudolf Gilmanshin, Jeroen Van Beek, and Robert Callender, *J. Physical Chemistry* **100**, 16754 (1996).
- "A Resonance Raman Study of the C=N Configuration of Octopus Rhodopsin, Bathorhodopsin, and Isorhodopsin", L. Huang, H. Deng, G. Weng, Y. Koutalos, T. Ebrey, M. Groesbeek, J. Lugtenburg, M. Tsuda, and R. H. Callender, *Biochemistry* **35**, 8504 (1996).
- "The Interactions Between Cellular Retinol Binding Protein (CRBP-I) and Retinal: a Vibrational Spectroscopic Study", Larry Senak, Zhongmo Ju, Noa Noy, Robert Callender, and Danny Manor, *Biospectroscopy* **3**, 131-142 (1997).
- "The Contribution of Electrostatic and van der Waals Interactions to the Stereospecificity of the Reaction Catalyzed by Lactate Dehydrogenase", Jeroen van Beek, Robert Callender, and M. R. Gunner, *Biophysical J.* **72**, 619 (1997).

- "Fast Events In Protein Folding: Relaxation Dynamics Of Secondary And Tertiary Structure In Native Apomyoglobin", Rudolf Gilmanshin, Skip Williams, Robert H. Callender, William H. Woodruff and R. Brian Dyer, Proc. Natl. Acad. Sci. (USA) 94, 3709-3713 (1997).
- "pH-dependent Conformational Changes in *Escherichia coli* Dihydrofolate Reductase Revealed by Raman Difference Spectroscopy", Yong Qing Chen, Joseph Kraut, Robert Callender, Biophysical J. 72, 936 (1997).
- "A Resonance Raman Study of the C=C Stretch Modes in Bovine and Octopus Visual Pigments with Isotopically Labeled Retinal Chromophores", L. Huang, H. Deng, G. Weng, Y. Koutalos, T. Ebrey, M. Groesbeek, J. Lugtenburg, M. Tsuda, and R. H. Callender, Photochem. Photobiol. 66, 747 (1997).
- "Structural Heterogeneity of the Various Forms of Apomyoglobin: Implications for Protein Folding", R. Gilmanshin, R. B. Dyer, and R. H. Callender, Protein Science 6, 2134 (1997).
- "Fast Events In Protein Folding: Structure And Relaxation Dynamics Of The 'I' Form Of Apomyoglobin," Rudolf Gilmanshin, Skip Williams, Robert H. Callender, R. Brian Dyer and William H. Woodruff, Biochemistry 36, 15006, 1997.
- "Relationship Between Bond Stretching Frequencies and Internal Bonding for [¹⁶O₄] and [¹⁸O₄] Phosphates in Aqueous Solution", Hua Deng, Jianghua Wang, W. J. Ray, and Robert Callender, J. Phys. Chem. 102, 3617-3623 (1998).
- "The Structure of the Ribonuclease•Uridine-Vanadate Transition State Analog Complex by Raman Difference Spectroscopy: Mechanistic Implications", Hua Deng, John Burgner, and Robert Callender, J. Am. Chem. Soc. 120, 4717-4722 (1998).
- "Characterization of Hydrogen Bonding in the Complex of Adenosine Deaminase with a Transition State Analog: A Raman Spectroscopic Study", Hua Deng, Linda Kurz, Frederick Rudolph, and Robert Callender, Biochemistry 37, 4968-4976 (1998).
- "The Core of Apomyoglobin E-Form: Folding at the Diffusion Limit", Rudolf Gilmanshin, Robert Callender, and R. Brian Dyer, Nature Structure Biology 5, 363-365 (1998).
- "Raman Difference Spectroscopic Studies of the Myosin S1•MgADP•Vanadate Complex", Hua Deng, Jianghua Wang, Robert H. Callender, Jean C. Grammer, and Ralph G. Yount, Biochemistry 37, 10972-10979 (1998).
- "Raman Difference Studies of GDP and GTP Binding to c-Harvey ras", J.H. Wang, D.G. Xiao H. Deng, M. Webb and R. H. Callender, Biochemistry 37, 11106-11116 (1998).
- "The Structure of Dihydrofolate when Bound to Dihydrofolate Reductase", Hua Deng and Robert Callender, J. Am. Chem. Soc. 120, 7730-7737 (1998).
- "Vibrational Study of Phosphate Modes in GDP and GTP and Their Interaction with Magnesium in Aqueous Solution", J. H. Wang, D. G. Xiao, H. Deng, Robert Callender, and Martin R. Webb, Biospectroscopy 4, 219-228 (1998).
- "A Raman Spectroscopic Characterization of Bonding in the Complex of Horse Liver Alcohol Dehydrogenase with NADH and *N*-Cyclohexylformamide," Hua Deng, John F. Schindler, Kristine B. Berst, Bryce V. Plapp, and Robert Callender, Biochemistry 37, 14267-14278 (1998).
- "Light Activates Reduction of Methotrexate by NADPH in the Ternary Complex with *Escherichia coli* Dihydrofolate Reductase", Yong-Qing Chen, M. Gulotta, H. T. Andrew Cheung, and Robert Callender, Photochem. Photobiol. 69, 77 (1999).
- "Femtosecond Polarized Pump-Probe and Stimulated Emission Spectroscopy of the Isomerization Reaction of Rhodopsin", Gilad Harad, Elisabeth A. Morlino, Jens Mathes, Robert Callender, and Robbin M. Hochstrasser, J. Phys. Chem. A 103, 2202-2207 (1999).
- "An FTIR Study of the Complex Melting Behavior of α -Lactalbumin", Hui Zhong, Rudolf Gilmanshin, and Robert Callender, J. Phys. Chem. B 103, 3947-3953 (1999).
- "A Vibrational Structure of 7,8-Dihydrobiopterin Bound to Dihydroneopterin Aldolase", Hua Deng, Robert Callender, and Glenn E. Dale, J. Biol. Chem. 275, 30139-30143 (2000).

- "Femtosecond Dynamics of Rhodopsin Photochemistry Probed by a Double Pump Spectroscopic Approach", Ming Yan, Louis Rothberg, and Robert Callender, *J. Physical Chem. B* **105**, 856-859 (2001).
- "The Vibrational Structure of GDP and GTP Bound to RAS: An Isotope Edited FTIR Study", Hu Cheng, Sean Sukal, Hua Deng, Thomas Leyh, and Robert Callender, *Biochemistry* **40**, 4035-4043 (2001).
- " γ -Phosphate Protonation and pH-Dependent Unfolding of the ras•GTP•Mg²⁺ Complex: An FTIR Study", Hu Cheng, Sean Sukal, Robert Callender, and Thomas Leyh, *J. Biol. Chem.* **276**, 9931-9935 (2001).
- "The Structures of Apomyoglobin's Various Acid Destabilized Forms", Rudolf Gilmanshin, Miriam Gulotta, R. Brian Dyer, and Robert Callender, *Biochemistry* **40**, 5127-5136 (2001).
- "Core Formation in Apomyoglobin: Probing the Upper Reaches of the Folding Energy Landscape", Miriam Gulotta, Rudolf Gilmanshin, Thomas C. Buscher, Robert Callender, and R. Brian Dyer, *Biochemistry* **40**, 5137-5143 (2001).
- "The Dynamics of Protein Ligand Binding on Multiple Time Scales: NADH Binding to Lactate Dehydrogenase", Hong Deng, Nick Zhadin, and Robert Callender, *Biochemistry* **40**, 3767-3773 (2001).
- "Vibrational Structure of Dihydrofolate Bound to R67 Dihydrofolate Reductase", Hua Deng, Robert Callender, Elizabeth Howell, *J. Biol. Chem.* **276**, 48956-48960 (2001).
- "The Physical Properties of Compounds that Promote the Oral Delivery of Macromolecular Drugs", Ruel Desamero, Hu Cheng, Sean Cahill, Mark Girvin, Robert Callender, Parshuram Rath, Bruce Variano, and John E. Smart, *Biospectroscopy* **67**, 26-40 (2002).
- "Interactions of Amidated Acids with Heparin", Ruel Desamero, Hu Cheng, Sean Cahill, Mark Girvin, Robert Callender, Parshuram Rath, Bruce Variano, and John E. Smart, *Biospectroscopy* **67**, 41-48 (2002).
- "Vibrational Structure of NADH Cofactors Bound to Glycerol-3-Phosphate Dehydrogenase and Dogfish Lactate Dehydrogenase," Jeroen van Beek, Hua Deng, Robert Callender, and John Burgner, *J. Raman Spectroscopy* **33**, 397-403 (2002).
- "Towards an Understanding of the Role of Dynamics on Enzymatic Catalysis in Lactate Dehydrogenase", Miriam Gulotta, Hua Deng, Hong Deng, R. Brian Dyer, and Robert H. Callender, *Biochemistry* **41**, 3353-3363 (2002).
- "Vibrational Structure of NAD(P) Cofactors Bound to Three NAD(P) Enzymes: an investigation of ground state activation", Yong-Qing Chen, Jeroen van Beek, Hua Deng, John Burgner, and Robert Callender, *J. Phys. Chem. B* **106**, 10733-10740 (2002).
- "Is the PTPase-Vanadate Complex a True Transition State Analog?", Hua Deng, Robert Callender, Zhonghui Huang, and Zhong-Yin Zhang, *Biochemistry* **41**, 5865-5872 (2002).
- "Determination of the Ionization State and Catalytic Function of Glu-133 in Peptide Deformylase by Difference FTIR Spectroscopy", Hua Deng, Robert Callender, Jinge Zhu, Kiet T. Nguyen, and Dehua Pei, *Biochemistry* **41**, 10563-10569 (2002).
- "Environmental Effects on Phosphoryl Group Bonding Probed by Vibrational Spectroscopy: Implications for Understanding Phosphoryl Transfer and Enzymatic Catalysis", Hu Cheng, Ivana Nikolic-Hughes, J. H. Wang, Hua Deng, Patrick J. O'Brien, Li Wu, Zhong-Yin Zhang, Daniel Herschlag, and Robert Callender, *J. Am. Chem. Soc.* **124**, 11295-11306 (2002).
- "Primary Folding Dynamics Of Sperm Whale Apomyoglobin: Core Formation", Miriam Gulotta, Eduard Rogatsky, Robert Callender, and R. Brian Dyer, *Biophysical J.* **84**, 1909-1918 (2003).
- "Active Site Loop Motion in Triosephosphate Isomerase: T-jump relaxation spectroscopy of thermal activation", Ruel Desamero, Sharon Rozovsky, Nick Zhadin, Ann McDermott, Robert Callender, *Biochemistry* **42**, 2941-2951 (2003).
- "The Assignment of Downfield Proton Resonances in an Enzyme Inhibitor Complex Using Time-dependent Saturation Transferred NOE", Hua Deng, Sean Cahill, Linda Kurz, and Robert Callender, *J. Am. Chem. Soc.* **126**, 1952-1953 (2004).

- "Assignment of Downfield Proton Resonances in Purine Nucleoside Phosphorylase•Immucillin-H complex by Saturation-Transferred NOEs", Hua Deng, Andrzej Lewandowicz, Sean M. Cahill, Richard H. Furneaux, Peter C. Tyler, Mark E. Girvin, Robert H. Callender, and Vern L. Schramm, *Biochemistry* 43, 1980-1987 (2004).
- "Activating The Phosphate Nucleophile At The Catalytic Site Of Purine Nucleoside Phosphorylase: a vibrational spectroscopic study", Hua Deng, Andrzej Lewandowicz, Vern L. Schramm, and Robert Callender, *J. Am. Chem. Soc.* 126, 9516-9517 (2004).
- "Active Site Contacts in the Purine Nucleoside Phosphorylase•hypoxanthine Complex by NMR and ab initio Calculations", Hua Deng, Seam Cahill, Andrzej Lewandowicz, Robert Callender, Vern Schramm, and Roger Jones, *Biochemistry* 43, 15966-74 (2004).
- "Structural Transformations in the Dynamics of Michaelis Complex Formation in Lactate Dehydrogenase", Sebastian McClendon, Dung M. Vu, Keith Clinch, Robert Callender, and R. Brian Dyer, *Biophysical J. Letter* 89, L07-L09 (2005).
- "The Approach to the Michaelis Complex in Lactate Dehydrogenase: the substrate binding pathway", Sebastian McClendon, Nick Zhadin, and Robert Callender, *Biophysical J.* 89, 2024-2032 (2005).
- "Loop Dynamics and ligand binding kinetics in the reaction catalyzed by the Yersinia protein tyrosine phosphatase", Mazdak Khajepour, Li Wu, Sijiu Liu, Zhong-Yin Zhang, Nick Zhadin and Robert Callender, *Biochemistry* 46, 4370-4378 (2007).
- "Effects of Cell Volume Regulating Osmolytes on Glycerol-3-phosphate Binding to Triosphosphate Isomerase", Miriam Gulotta, Linlin Qiu, Jorg Rosgen, D. Wayne Bolen, and Robert Callender, *Biochemistry* 46, 10055-10062 (2007).
- "Ligand Binding and Protein Dynamics in Lactate Dehydrogenase", J. R. Exequiel T. Pineda, Robert Callender, and Steven D. Schwartz, *Biophysical J.* 93, 1474-1483 (2007).
- "Lactate Dehydrogenase Undergoes a Substantial Structural Change to Bind its Substrate", Linlin Qiu, Miriam Gulotta, and Robert Callender, *Biophysical J.* 93, 1677-1686 (2007).
- "On the Pathway of Forming Enzymatically Productive Ligand-protein Complexes in Lactate Dehydrogenase", Hua Deng, Scott Brewer, Dung M. Vu, Keith Clinch, Robert Callender, and R. Brian Dyer, *Biophysical J.* 95, 804-813 (2008).
- "Probing the Role of Dynamics in Hydride Transfer Catalyzed by Lactate Dehydrogenase", Nickolay Zhadin, Miriam Gulotta, and Robert Callender", *Biophysical J.* 95, 1974-1984 (2008).
- "Tryptophan-free Human PNP Reveals Catalytic Site Interactions", Vern Schramm, Suwipa Saen-oon, Mahmoud Ghanem, Nick Zhadin, Corin Wing, Sean Cahill, Steven Schwartz, and Robert Callender. *Biochemistry* 47, 3202-3015 (2008). PMID: 18269249
- "Loop-Tryptophan Human PNP Reveals Submillisecond Protein Dynamics", Mahmoud Ghanem, Nickolay Zhadin, Robert Callender, Vern L. Schramm, *Biochemistry* 48, 3658 (2009). PMC2674222
- "Pyrophosphate Activation in Hypoxanthine-Guanine Phosphoribosyltransferase with Transition State Analogue", Hua Deng, Robert Callender, Vern Schramm, and Charles Grubmeyer, *Biochemistry* 49, 2705-2714 (2010). PMC2851198
- "The Effect of Osmolytes on Protein Dynamics in the LDH-Catalyzed Reaction", Nicolay Zhadin and Robert Callender, *Biochemistry* 50, 1582-1589 (2011). PMC3075470
- "Conformational heterogeneity within the Michaelis complex of lactate dehydrogenase", Hua Deng, Dung Vu, Keith Clinch, Ruel Desamero, R. Brian Dyer, and Robert Callender, *J. Phys. Chem. B.* 115, 7670-6778 (2011). PMC3111758
- "Investigation of Catalytic loop Structure, Dynamics, and Function Relationship of Yersina Protein Tyrosine Phosphatase by Temperature-Jump Relaxation Spectroscopy and X-ray Structural Determination", Shan Ke, Meng-Chio Ho, Nickolas Zhadin, Hua Deng, and Robert Callender, *J. Phys. Chem. B.* 116, 6166-6176 (2012). PMC3380360
- "Large Scale Dynamics of the Michaelis Complex of B. Stearotherophilus Lactate Dehydrogenase revealed by Single Tryptophan Mutants Study", Beining Nie, Hua Deng, Ruel Desamero, Robert Callender, *Biochemistry* 52, 1886-1892 (2013). PMC3604157.

- “Energy Landscape of the Michaelis Complex of Lactate Dehydrogenase: relationship to catalytic mechanism”, Hua Deng, Ho-Lei Peng, Michael Reddish, R. Brian Dyer, Robert Callender, *Biochemistry* 53, 1849-1857 (2014). PMC3985751
- “Direct Evidence of Catalytic Heterogeneity in Lactate Dehydrogenase by Temperature Jump Infrared Spectroscopy”, Michael Reddish”, Huo-Lei Peng, Hua Deng, Kunal Panwar, Robert Callender, R. Brian Dyer, *J. Phys. Chem. B* 118, 10854-10862 (2014). PMC4167064
- "Mechanisms of Thermal Adaptation in the Lactate Dehydrogenases", Huo-Lei Peng, Tsuyoshi Egawa, Eric Chang, Hua Deng, Robert Callender, *J. Phys. Chem. B* 119, 15256-15262 (2015). PMC4679558
- “Active Loop Dynamics within the Michaelis Complex of Lactate Dehydrogenase from *bsStearothermophilus*”, Beining, Nie, Lodewyks, Kara, Deng, H, Desamero, Ruel, and Callender, R. H. *Biochemistry* 55, 3803-3814 (2016). PMC5235360
- “Mechanistic Analysis of Fluorescence Quenching of Reduced Nicotinamide Adenine Dinucleotide by Oxamate in Lactate Dehydrogenase Ternary Complexes.” Peng, H.-L.; Callender, R. H., *Photochemistry and Photobiology* 2017, in press.
- “Resolution of sub-millisecond kinetics of multiple reaction pathways for lactate dehydrogenase”, Reddish, M., Callender, R. H., and Dyer, R. B., *Biophysical J*, in press (2017).
- “Thermodynamic and structural adaptation differences between mesophilic and psychrophilic lactate dehydrogenases,” Khrapunov, S.; Chang, E.; Callender, R. H., *Biochemistry*. 2017, submitted.
- “Structural interpretations of the Observed Catalytic Loop Dynamics of *Yersinia* Protein Tyrosine Phosphatase by NEB/HFB Computational Studies. Deng, H.; Ke, S.; Callender, R. H.; Balakrishnan, G.; Spiro, T.; Arora, K.; Brooks III, C. L., 2017, in preparation.

Publications bob.cv