

Curriculum Vitae

DOUGLAS H. TURNER

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Personal Data:

Year of Birth: 1946
Citizenship: U.S.
Marital Status: Married to Joanna B. Olmsted; one child, Richard
Military Status: Captain, U. S. Army Reserve, inactive

Education:

1967 Harvard College, A.B. cum laude in Chemistry
1972 Columbia University, Ph.D., Physical Chemistry,
Advisors, G. W. Flynn and N. Sutin (Brookhaven National Labs)
1973-74 University of California, Berkeley, Postdoctoral Fellow,
Biophysical Chemistry, with I. Tinoco, Jr.

Professional Experience:

1975-81 Assistant Professor of Chemistry, University of Rochester
1981-85 Associate Professor of Chemistry, University of Rochester
1986- Professor of Chemistry, University of Rochester
1999-09 Professor of Pediatrics, University of Rochester,
School of Medicine and Dentistry

Honors:

National Institutes of Health Predoctoral Fellowship	1968-1972
Alfred P. Sloan Fellow	1979-1983
NIH Senior Fellowship, University of Colorado, Boulder	1984-1985
Member, Biomedical Sciences Study Section, NIH	1984-1988
Member, Editorial Board of <i>Biophysical Journal</i>	1992-1995, 1997-2003
Guggenheim Fellow and American Cancer Society Scholar	1993-1994
Co-chair, Nucleic Acids Gordon Conference	1995
Member, BBKA Study Section, NIH	1995-1999
Member, Editorial Board of <i>Folding and Design</i>	1996-1998
Associate-director, University of Rochester M.D./Ph.D. Program	1998-2014
Bridging Fellowship to Department of Pediatrics, University of Rochester	1999
Fellow, American Association for the Advancement of Science	1999
Member, International Advisory Board of the Institute of Bioorganic Chemistry, Polish Academy of Sciences, Poznan	2002-2013
Member, Biomedical Research and Research Training Subcommittee A, NIH	2004-2008
Gordon Hammes Lectureship sponsored by the journal, <i>Biochemistry</i> , and the Biological Chemistry Section of the American Chemical Society	2011

University of Rochester Doctoral Commencement Award for Lifetime Achievement in Graduate Education	2014
American Association for the Advancement of Science Poland – US Science Award (shared with Ryszard Kierzek)	2016
Honorary member, Phi Beta Kappa, Harvard College	2017
Total publications exceed 250	2022
Total citations exceed 20,000 (H-index > 70)	2022

Publications

1. "The Stimulated Raman Effect. A New Source of Laser Temperature-Jump Heating," J. V. Beitz, G. W. Flynn, D. H. Turner, and N. Sutin, *J. Am. Chem. Soc.*, 92, 4130-4132 (1970).
2. "Laser Raman Temperature-Jump Study of the Kinetics of the Triiodide Equilibrium. Relaxation Times in the 10^{-7} - 10^{-8} Second Range," D. H. Turner, G. W. Flynn, N. Sutin, and J. V. Beitz, *J. Am. Chem. Soc.*, 94, 1554-1559 (1972).
3. "Dimerization of Proflavin by the Laser Raman Temperature-Jump Method," D. H. Turner, G. W. Flynn, S. K. Lundberg, L. D. Faller, and N. Sutin, *Nature*, 239, 215-217 (1972).
4. "Raman Laser Temperature-Jump Studies," Ph.D. Thesis, Columbia University (1972).
5. "Rate of Intersystem Crossing between 1A and 5A States of an Iron(II) Complex in Solution," J. K. Beattie, N. Sutin, D. H. Turner and G. W. Flynn, *J. Am. Chem. Soc.*, 95, 2052-2054 (1973).
6. "Fluorescence Detected Circular Dichroism," D. H. Turner, I. Tinoco, Jr., and M. Maestre, *J. Am. Chem. Soc.*, 96, 4340-4342 (1974).
7. "Kinetics of the Stacking of Ethidium Bromide by the Raman Laser Temperature-Jump Method," D. H. Turner, R. Yuan, G. W. Flynn and N. Sutin, *Biophysical Chemistry*, 2, 385-389 (1974).
8. "The Kinetics of Codon-Anticodon Interaction in Yeast Phenylalanine Transfer RNA," K. Yoon, D. H. Turner, and I. Tinoco, Jr., *J. Mol. Biol.*, 99, 507-518 (1975).
9. "Fluorescence Detected Circular Dichroism Study of the Anticodon Loop of Yeast tRNA^{Phe}," D. H. Turner, I. Tinoco, Jr., and M. Maestre, *Biochemistry*, 14, 3794-3799 (1975).
10. "Some Very Rapid Reactions of Porphyrins in Aqueous Solution," R. F. Pasternack, N. Sutin, and D. H. Turner, *J. Am. Chem. Soc.*, 98, 1908-1913 (1976).
11. "Fluorescence Detected Circular Dichroism. Theory," I. Tinoco, Jr. and D. H. Turner, *J. Am. Chem. Soc.*, 98, 6453-6456 (1976).
12. "The Kinetics of Binding of U-U-C-A to a Dodecanucleotide Anticodon Fragment from Yeast tRNA^{Phe}," K. Yoon, D. H. Turner, I. Tinoco, Jr., F. von der Haar, and F. Cramer, *Nucleic Acids Research*, 3, 2233-2241 (1976).
13. "Solvent Effects on Stacking: A Kinetic and Spectroscopic Study of Thionine Association in Aqueous Alcohol Solutions," T. G. Dewey, P. S. Wilson, and D. H. Turner, *J. Am. Chem. Soc.*, 100, 4550-4554 (1978).
14. "Fluorescence-Detected Circular Dichroism," D. H. Turner, *Methods in Enzymology*, Vol. 49G, ed. by C. H. W. Hirs and S. N. Timasheff, Chapter 8, Academic Press, 1978.
15. "Raman Laser Temperature-Jump Kinetics," T. G. Dewey and D. H. Turner, *Adv. Molec. Relaxation*, 13, 331-350 (1978).
16. "Comparative Biophysical Analysis of Monoclonal Cryo and Noncryoprecipitable IgG1, IgG2 and IgG3 Globulins," C. D. Scoville and D. H. Turner, *Fed. Proc.*, 37, 1853 (1978).

17. "Photoselected Fluorescence Detected Circular Dichroism," E. W. Lobenstine and D. H. Turner, *J. Am. Chem. Soc.*, 101, 2205-2207 (1979).
18. "Laser Temperature Jump Study of Solvent Effects on Proflavin Stacking," T. G. Dewey, D. A. Raymond, and D. H. Turner, *J. Am. Chem. Soc.*, 101, 5822-5826 (1979).
19. "Spectroscopic and Kinetic Analysis of a Monoclonal IgG Cryoglobulin. Effect of Mild Reduction on Cryoprecipitation," C. D. Scoville, G. N. Abraham, and D. H. Turner, *Biochemistry*, 18, 2610-2615 (1979).
20. "Raman Laser Temperature Jump Study of Solvent Effects on Simple Stacking Systems," T. G. Dewey and D. H. Turner, "NATO Adv. Study Inst. Ser., Techniques and Applications of Fast Reactions in Solution," ed. by E. Wyn-Jones, D. Reidel, Pub., p. 235-238 (1979).
21. "Laser Temperature-Jump Study of Stacking in Adenylic Acid Polymers," T. G. Dewey and D. H. Turner, *Biochemistry*, 18, 5757-5762 (1979).
22. "Laser Temperature Jump Study of Solvent Effects on Poly (adenylic acid) Stacking," T. G. Dewey and D. H. Turner, *Biochemistry*, 19, 1681-1685 (1980).
23. "Study of the Kinetic and Structural Properties of a Monoclonal Immunoglobulin G Cryoglobulin," C. D. Scoville, D. H. Turner, J. L. Lippert, and G. N. Abraham, *J. Biol. Chem.*, 255, 5847-5852 (1980).
24. "Intersystem-Crossing Dynamics and Coordination Geometry Changes Observed by Ultrasonic and Laser Temperature-Jump Relaxation of the $^2T^6A$ Spin Equilibrium of Hexadentate Iron (III) Complexes in Solution," R. A. Binstead, J. K. Beattie, T. G. Dewey and D. H. Turner, *J. Am. Chem. Soc.*, 102, 6442-6451 (1980).
25. "Further Verification of Fluorescence-Detected Circular Dichroism," E. W. Lobenstine and D. H. Turner, *J. Am. Chem. Soc.*, 102, 7786-7787 (1980).
26. "Thermodynamics of (dG-dC)₃ Double-Helix Formation in H₂O and D₂O," D. D. Albergo, L. A. Marky, K. J. Breslauer, and D. H. Turner, *Biochemistry*, 20, 1409-1413 (1981).
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28. "Solvent Effects on the Kinetics and Thermodynamics of Stacking in Poly (cytidylic acid)," S. M. Freier, K. O. Hill, T. G. Dewey, L. A. Marky, K. J. Breslauer, and D. H. Turner, *Biochemistry*, 20, 1419-1426 (1981).
29. "Fluctuation in Optical Activity: A Probe of Fast Reactions Using Light Scattering," T. G. Dewey, D. H. Turner, and M. G. Sceats, *J. Chem. Phys.*, 74, 6592-6602 (1981).
30. "Fluorescence Detected Circular Dichroism of Proteins with Single Fluorescent Tryptophans," E. W. Lobenstine, W. C. Schaefer, and D. H. Turner, *J. Am. Chem. Soc.*, 103, 4936-4940 (1981).
31. "Why Do Nucleic Acids Form Helices?" D. H. Turner, M. Petersheim, D. D. Albergo, T. G. Dewey, and S. M. Freier, in "Bimolecular Stereodynamics," ed. by R. H. Sarma, pp. 429-438 (1981).
32. "Laser Crosslinking of *E. coli* RNA Polymerase and T7 DNA," C. A. Harrison, D. H. Turner,

and D. C. Hinkle, *Nucleic Acids Res.*, 10, 2399-2414 (1982).

33. "Base-Stacking and Pairing Contributions to Helix Stability: Thermodynamics of Double Helix Formation with CCGG, CCGGp, ACCGGp, CCGGAp CCGGUp, and ACCGGUp," M. Petersheim and D. H. Turner, *Biochemistry*, 22, 256-263 (1983).
34. "Nuclear Overhauser Studies of CCGGAp, ACCGGp, and ACCGGUp," M. Petersheim and D. H. Turner, *Biochemistry*, 22, 264-268 (1983).
35. "Proton Magnetic Resonance Melting Studies of CCGGp, CCGGAp, CCGGUp, ACCGGp, and ACCGGUp," M. Petersheim and D. H. Turner, *Biochemistry*, 22, 269-277 (1983).
36. "Solvent Effects on the Dynamics of (dG-dC)₃," S. M. Freier, D. D. Albergo, and D. H. Turner, *Biopolymers*, 22, 1107-1131 (1983).
37. "Effects of 3' Dangling End Stacking on the Stability of GGCC and CCGG Double Helices," S. M. Freier, B. J. Burger, D. Alkema, T. Neilson, and D. H. Turner, *Biochemistry*, 22, 6198-6206 (1983).
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40. "Fluorescence-Detected Circular Dichroism of Ethidium in Vivo and Bound to Deoxyribonucleic Acid in Vitro," M. L. Lamos and D. H. Turner, *Biochemistry*, 24, 2819-2822 (1985).
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44. "Molecular Complexes of Nucleosides and Nucleotides with a Monomer Cationic Porphyrin and Some of Its Metal Derivatives," R. F. Pasternack, E. J. Gibbs, A. Gaudemer, A. Antebi, S. Bassner, L. De Poy, D. H. Turner, A. Williams, F. Laplace, M. H. Lansard, C. Merienne and M. Peree-Fauvet, *J. Am. Chem. Soc.*, 107, 8179-8186 (1985).
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46. "Temperature-Jump Methods," D. H. Turner, in "Investigation of Rates and Mechanisms of Reactions, vol. VI, Part II," 4th edition, ed. by C. F. Bernasconi, Chapter 3, Techniques of Chemistry series, Wiley-Interscience, (1986).

47. "Fluorescence-Detected Circular Dichroism of Ethidium Bound to Poly(dG-dC) and Poly(dG-m⁵dC) under B- and Z-Form Conditions," M. L. Lamos, G. T. Walker, T. R. Krugh, and D. H. Turner, *Biochemistry*, 25, 687-691 (1986).
48. "Free Energy Contributions of G•U and Other Terminal Mismatches to Helix Stability," S. M. Freier, R. Kierzek, M. H. Caruthers, T. Neilson, and D. H. Turner, *Biochemistry*, 25, 3209-3213 (1986).
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53. "Improved Free Energy Parameters for Prediction of RNA Duplex Stability," S. M. Freier, R. Kierzek, J. A. Jaeger, N. Sugimoto, M. H. Caruthers, T. Neilson, and D. H. Turner, *Proc. Natl. Acad. Sci. U.S.A.*, 83, 9373-9377 (1986). [by 9/2021 cited over 1900 times]
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55. "Improved Parameters for Prediction of RNA Structure," D. H. Turner, N. Sugimoto, J. A. Jaeger, C. E. Longfellow, S. M. Freier, and R. Kierzek, *Cold Spring Harbor Symposium, Quant. Biol.*, 52, 123-133 (1987).
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57. "Sequence Dependence for the Energetics of Terminal Mismatches in Ribooligonucleotides," N. Sugimoto, R. Kierzek, and D. H. Turner, *Biochemistry*, 26, 4559-4562 (1987).
58. "RNA Structure Prediction," D. H. Turner, N. Sugimoto and S. M. Freier, *Ann. Rev. Biophysics and Biophysical Chem.*, 17, 167-192 (1988). [7/2022 cited over 850 times]
59. "Kinetics for Reaction of a Circularized Intervening Sequence with CU, UCU, CUCU, and CUCUCU: Mechanistic Implications from the Dependence on Temperature, and on Oligomer and Mg²⁺ Concentrations," N. Sugimoto, R. Kierzek, and D. H. Turner, *Biochemistry*, 6384-6392 (1988).
60. "Hydrogen Bonding and Stacking Contributions to Nucleic Acid Stability," D. H. Turner, N. Sugimoto, S. D. Dreiker, S. M. Freier, and R. Kierzek, in *Structure and Expression, Vol. 1: From Proteins to Ribosomes*, ed. by R. H. Sarma and M. H. Sarma, p. 249-259 (1988).

61. "Effects of Substrate Structure on the Kinetics of Circle Opening Reactions of the Self-Splicing Intervening Sequence from *Tetrahymena thermophila*: Evidence for Substrate and Mg^{2+} Binding Interactions," N. Sugimoto, M. Tomka, R. Kierzek, P. Bevilacqua, and D. H. Turner, *Nucleic Acids Research*, 17, 355-371 (1989).
62. "Laser Temperature-Jump, Spectroscopic and Thermodynamic Study of Salt Effects on Duplex Formation by dGCATGC," A. P. Williams, C. E. Longfellow, S. M. Freier, R. Kierzek, and D. H. Turner, *Biochemistry*, 28, 4283-4291 (1989).
63. "Binding of a Fluorescent Oligonucleotide to a Circularized Intervening Sequence from *Tetrahymena thermophila*," N. Sugimoto, M. Sasaki, R. Kierzek, and D. H. Turner, *Chemistry Letters*, 2223-2226 (1989).
64. "Improved Predictions of Secondary Structures for RNA," J. A. Jaeger, D. H. Turner, and M. Zuker, *Proc. Natl. Acad. Sci. U.S.A.*, 86, 7706-7710 (1989).
65. "Predicting Optimal and Suboptimal Secondary Structure for RNA," J. A. Jaeger, D. H. Turner, and M. Zuker, *Methods in Enzymology*, Vol. 183, 280-305 (1990).
66. "Thermodynamic and Spectroscopic Study of Bulge Loops in Oligoribonucleotides," C. E. Longfellow, R. Kierzek, and D. H. Turner, *Biochemistry*, 29, 278-285 (1990).
67. "Thermodynamics and Kinetics of Base-Pairing and of DNA and RNA Self-Assembly and Helix-Coil Transition," D. H. Turner, N. Sugimoto, and S. M. Freier, in "Nucleic Acids," Vol. 1c by W. Saenger, Landolt-Bornstein series, Springer-Verlag, Berlin, p. 201-227 (1990).
68. "Effects of GA Mismatches on the Structure and Thermodynamics of RNA Internal Loops," J. SantaLucia, Jr., R. Kierzek, and D. H. Turner, *Biochemistry*, 29, 8813-8819 (1990).
69. "Melting and Chemical Modification of a Cyclized Self-Splicing Group I Intron: Similarity of Structures in 1 M Na^+ , in 10 mM Mg^{2+} , and in the Presence of Substrate," J. A. Jaeger, M. Zuker, and D. H. Turner, *Biochemistry*, 29, 10147-10158 (1990).
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74. "Comparison of Binding of Mixed Ribose-Deoxyribose Analogues of CUCU to a Ribozyme and to GGAGAA by Equilibrium Dialysis: Evidence for Ribozyme Specific Interactions with 2' OH Groups," P. C. Bevilacqua and D. H. Turner, *Biochemistry*, 30, 10632-10640 (1991).

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76. "Inhibition of Deoxyribo Oligonucleotides on the Circle Opening Reaction of the Intervening Sequence from *Tetrahymena thermophila*," N. Sugimoto, M. Sasaki, R. Kierzek, and D. H. Turner, *Chemistry Letters*, 747-748 (1990).
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78. "Bulges in Nucleic Acids," D. H. Turner, invited review for *Current Opinion in Structural Biology*, **2**, 334-337 (1992).
79. "Context Dependence of Hydrogen Bond Free Energy Revealed by Substitutions in an RNA Hairpin," J. SantaLucia, Jr., R. Kierzek, and D. H. Turner, *Science*, **256**, 217-219 (1992).
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81. "Thermodynamic Considerations for Evolution by RNA," D. H. Turner and P. C. Bevilacqua, invited chapter in *The RNA World*, ed. by R. F. Gesteland and J. F. Atkins, Cold Spring Harbor Press, p. 447-464 (1993).
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86. "RNA Hairpin Loop Stability Depends on Closing Base Pair," M. J. Serra, M. H. Lyttle, T. J. Axenson, C. A. Schadt, and D. H. Turner, *Nucleic Acids Res.*, **21**, 3845-3849 (1993).
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216. "Revision of AMBER Torsional Parameters for RNA Improves Free Energy Predictions of Tetramer Duplexes with GC and iG/C Base Pairs," I. Yildirim, S. D. Kennedy, H. A. Stern, J. M. Hart, R. Kierzek, and D. H. Turner, *J. Chem. Theory Computation*, 8, 172-181 (2012).
217. "Testing the Nearest Neighbor Model for Canonical RNA Base Pairs: Revision of GU Parameters," J. L. Chen, A. L. Dishler, S. D. Kennedy, I. Yildirim, B. Liu, D. H. Turner, and M. J. Serra, *Biochemistry* 51, 3508-3522 (2012).
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219. "The 3' Splice Site of Influenza A Segment 7 mRNA Can Exist in Two Conformations: A Pseudoknot and a Hairpin," W. N. Moss, L. I. Dela-Moss, E. Kierzek, R. Kierzek, S. F. Priore, and D. H. Turner, *PLoS ONE*, 7(6): e38323. Doi:10.1371/journal.pone.0038323. (2012).
220. "The Influenza A Segment 7 mRNA 3' Splice Site Pseudoknot/Hairpin Family," W. N. Moss, L. I. Dela-Moss, S. F. Priore, and D. H. Turner, *RNA Biology* 9, 1305-1310 (2012).
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223. "The Nuclear Magnetic Resonance of CCCC RNA Reveals a Right-Handed Helix, and Revised Parameters for AMBER Force Field Torsions Improve Predictions from Molecular Dynamics," J. D. Tubbs, D. E. Condon, S. D. Kennedy, M. Hauser, P. C. Bevilacqua, and D. H. Turner, *Biochemistry* 52, 996-1010 (2013).
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231. "Secondary Structure of a Conserved Domain in an Intron of Influenza A mRNA," T. Jiang, S. D. Kennedy, W. N. Moss, E. Kierzek, and D. H. Turner, *Biochemistry* 53, 5236-5248 (2014).
232. "Microarrays for Identifying Binding Sites and Probing Structure of RNAs," R. Kierzek, D. H. Turner, and E. Kierzek, *Nucleic Acids Res.* 43, 1-12 (2015).
233. "Stacking in RNA: NMR of Four Tetramers Benchmark Molecular Dynamics," D. E. Condon, S. D. Kennedy, B. C. Mort, R. Kierzek, I. Yildirim, and D. H. Turner, *J. Chem. Theory Comput.* 11, 2729-2742 (2015).
234. "Structural Features of a 3' Splice Site in Influenza A," J. L. Chen, S. D. Kennedy, and D. H. Turner, *Biochemistry* 54, 3269-3285 (2015).
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236. "Nuclear Magnetic Resonance-Assisted Prediction of Secondary Structure for RNA: Incorporation of Direction-Dependent Chemical Shift Constraints," J. L. Chen, S. Bellaousov, J. D. Tubbs, S. D. Kennedy, M. J. Lopez, D. H. Mathews, and D. H. Turner, *Biochemistry* 54, 6769-6782 (2015).
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239. "Antisense Oligonucleotides Targeting Influenza A Segment 8 Genomic RNA Inhibit Viral Replication," E. Lenartowicz, A. Nogales, E. Kierzek, R. Kierzek, L. Martinez-Sobrido, and D. H. Turner, *Nucleic Acid Therapeutics* 26, 277-285 (2016) (with cover illustration).
240. "Crystal Structure of a Poly(rA) Staggered Zipper at Acidic pH: Evidence that Adenine N1 Protonation Mediates Parallel Double Helix Formation," M. L. Gleghorn, J. Zhao, D. H. Turner, and L. E. Maquat, *Nucleic Acids Res.* 44, 8417-8424 (2016).
241. "RNA Structure Determination", D.H. Turner and D.H. Mathews, eds., Springer Humana Press (2016).
242. "RNA Secondary Structure Determination by NMR," J. L. Chen, S. Bellaousov, and D.H. Turner, *Meth. Molec. Biol.* 1490, 177- 186 (2016) [chap. 11 in *RNA Structure Determination*].
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245. "Nuclear Magnetic Resonance Structure of an 8X8 Nucleotide RNA Internal Loop Flanked on Each Side by Three Watson-Crick Pairs and Comparison to Three-Dimensional Predictions," A. D. Kauffmann, S. D. Kennedy, J. Zhao, and D. H. Turner, *Biochemistry*, 56, 3733-3744 (2017).
246. "Physics-based all-atom modeling of RNA energetics and structure," L.G. Smith, J. Zhao, D. H. Mathews, and D. H. Turner, *WIREs RNA*, 8e1422 (2017).
247. "Surprising Sequence Effects on GU Closure of Symmetric 2X2 Nucleotide Internal Loops," K. D. Berger, S. D. Kennedy, S. J. Schroeder, B. M. Znosko, H. Y. Sun, D. H. Mathews, and D. H. Turner, *Biochemistry* 57, 2121-2131 (2018).
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249. "Improving RNA Nearest Neighbor Parameters for Helices by Going Beyond the Two-State Model," A. Spasic, K. D. Berger, J. L. Chen, M. G. Seetin, D. H. Turner, and D. H. Mathews, *Nucleic Acids Res.* 46, 4883-4892 (2018).
250. "Molecular Dynamics Correctly Models the Unusual Major Conformation of the GAGU RNA Internal Loop and with NMR Reveals an Unusual Minor Conformation," A. Spasic, S. D. Kennedy, L. Needham, M. Manoharan, R. Kierzek, D. H. Turner and D. H. Mathews, *RNA* 24, 656-672 (2018).
251. "NMR Reveals that GU Base Pairs Flanking Internal Loops can Adopt Diverse Structures," K. D. Berger, S. D. Kennedy, and D. H. Turner, *Biochemistry* 58, 1094-1108 (2019).
252. "Accurate Geometrical Restraints for Watson-Crick Base Pairs," M. Gilski, J. Zhao, M. Kowiel, D. Brzezinski, D.H. Turner, and M. Jaskolski, *Acta Crystallographica Section B: Structural Science, Crystal Engineering and Materials* B75, 235-245 (2019).
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254. "Nuclear Magnetic Resonance of Single Stranded RNAs and DNAs of CAAU and UCAAUC as Benchmarks for Molecular Dynamics Simulations," J. Zhao, S.D. Kennedy, K.D. Berger, and D.H. Turner, *J. Chem. Theory Comput.* 16, 1968-1984 (2020).
255. "Nuclear Magnetic Resonance Spectra and AMBER OL3 and ROC-RNA Simulations of UCUCGU Reveal Force Field Strengths and Weaknesses for Single Stranded RNA," J. Zhao, S.D. Kennedy, and D.H. Turner, *J. Chem. Theory Comput.* 18, 1241-1254 (2022).
256. "Nuclear Magnetic Resonance Reveals a Two Hairpin Equilibrium near the 3'-Splice Site of Influenza A Segment 7 mRNA that can be Shifted by Oligonucleotides," A.D. Kauffmann, S.D. Kennedy, W.N. Moss, E. Kierzek, R. Kierzek, and D.H. Turner, *RNA* 28, 508-522. (2022).

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Research Support

American Chemical Society - Petroleum Research Fund, Type G Grant, "The Kinetics and Thermodynamics of Stacking Reactions", \$9,000, 1975-1977.

Research Corporation, "Fluorescence Detected Circular Dichroism Studies", \$16,790, 1975-1976.

National Science Foundation Department Equipment Grant, "Circular Dichroism Instrumentation", coauthored with T. R. Krugh, \$37,200, 1975-1976.

American Cancer Society Institutional Research Grant, "Sequence Specificity of Drug-Nucleic Acid Complexes", \$1,966, 1975-1976.

Alfred P. Sloan Fellowship, \$20,000, 1979-1983.

Biomedical Research Support Grant, "Laser Cross Linking of Nucleic Acids and Proteins, coauthored with D. C. Hinkle, \$5,000, 1979-1980.

National Institutes of Health, "Laser Cross Linking of Proteins and Nucleic Acids", \$79,765 (direct cost), 1980-1983.

National Institutes of Health, "Fluorescence Detected CD Studies of Nucleic Acids", \$81,006 (direct cost), 1981-1984.

Biomedical Research Support Grant, "Temperature Control for Absorption Spectroscopy", \$4,040, 1984-1985.

National Institutes of Health (National Research Service Award for Senior Fellowship), "Studies of Self Splicing RNA", \$30,140, 1984-1985.

National Institutes of Health, "Effects of Drugs on Nucleic Acids", \$94,346 (direct cost), 1984-1987.
National Institutes of Health, "500 MHz NMR Spectrometer" (DRR BRS Shared Instrumentation), \$300,000 (equipment only), Co-P.I. with T. R. Krugh, 1987.

Office of Naval Research, "Molecular Basis of RNA Catalysis," \$155,337 (direct cost), 1988-1991.

National Institutes of Health, "Computer Graphics Equipment" (DRR BRS Shared Instrumentation), \$172,000 (equipment only).

National Institutes of Health, GM22939, "Kinetic and Spectroscopic Studies of Nucleic Acids",

\$128,415 (direct cost), 1976-1979.

\$154,759 (direct cost), 1979-1982.

\$423,255 (direct cost), 1982-1987.

\$691,574 (direct cost), 1987-1992.

National Institutes of Health, GM22939, "Folding RNA: from AIDS to the Human Genome".

\$753,829 (direct cost), 1992-1996 (funded with priority score in top 2%)

\$876,545 (direct cost), 1996-2000, (funded with priority score in top 1%)

\$1,059,037 (direct cost), 2000-2004 (funded with priority score in top 6%)

\$1,211,970 (direct cost), 2004-2008 (funded with priority score in top 7%)

\$1,252,046 (direct cost), 2008-2013 (funded with priority score in top 10%)

\$ 110,000 (direct cost), 2012-2013 (funded supplement)

\$2,356,955 (total cost). 2013-2017 (funded with priority score in top 16%)

National Institutes of Health, 1 R03 TW 01068-01, "Folding RNA with Modified Oligonucleotides," (Fogarty International Research Collaboration Award to fund Dr. Ryszard Kierzek's synthesis program at the Polish Academy of Sciences, Institute of Bioorganic Chemistry in Poznan, Poland) \$82,285 (direct cost), 1999-2002, \$96,000 (direct costs), 2002-2005.

National Institutes of Health, 1 R03 AI 45398-01, "RNA Targeting with Tertiary Interactions," (Innovative Drug Discovery Research in AIDS Opportunistic Infections) \$100,000, 1999-2001.

National Institutes of Health, 1 R03 TW008739, "Folding RNA: Influenza," (Fogarty International Research Collaboration Award to fund Dr. Elzbieta Kierzek (Institute of Bioorganic Chemistry in Poznan, Poland) to work on determining structures of domains in influenza RNA and to discover oligonucleotides that could potentially serve as therapeutics. \$174, 509 (direct cost), 2011-2014 (priority score in top 2%).

Research Students

[“Position” is either last prior to retirement or current. Subsequent Positions are last known.]

Research Associates

Susan M. Freier

Ph.D., University of California, Berkeley, 1976

Position: Director of Molecular and Structural Biology at IONIS Pharmaceuticals, Carlsbad, CA.
Retired.

Naoki Sugimoto

Ph.D., Kyoto University, 1985

Positions: Professor of Chemistry, Konan University, Kobe, JAPAN
Director, Frontier Institute of Biomolecular Engineering Research (FIBER)

Sean Moran

Ph.D., University of Colorado, Boulder, 1987

Position: Director, Structural Biology Core Facility, Uniform Services University of the Health Sciences

Matthew Fountain

Ph.D., University of Rochester, 1994

Position: Professor and Chair of Chemistry, State University College at Fredonia NY

Stephen M. Testa (NIH Postdoctoral Fellow)

Ph.D., Purdue University, 1994

Position: Associate Professor of Chemistry, University of Kentucky

Sherry Spinelli

Ph.D., University of Rochester, 1999

Position: Research Associate Professor of Pathology and Laboratory Medicine, University of Rochester Medical Center

Irina Catrina

Ph.D., Utah State University, 2001

Position: Clinical Assistant Professor of Chemistry, Yeshiva University

Elzbieta Kierzek

Ph.D., Institute for Bioorganic Chemistry, Poznan, Polish Academy of Sciences

Position: Professor, Institute of Bioorganic Chemistry, Poznan

Elzbieta Lenartowicz

Ph.D., Institute for Bioorganic Chemistry, Poznan, Polish Academy of Sciences, 2016

Position: Head of Laboratory of Molecular Diagnostics, Institute for Bioorganic Chemistry, Poznan, Polish Academy of Sciences

Ph.D. Students

1979 T. Gregory Dewey

“Laser Temperature Jump Kinetics of Solvent Effects on Stacking Reactions in Dyes and Nucleic Acids”

Position: President, Albany College of Pharmacy and Health Sciences

- 1980 Craig D. Scoville
“Studies on a Monoclonal IgG Cryoglobulin”, joint student with G. N. Abraham
(Department of Microbiology)
Position: Practicing Physician
- 1981 Eric W. Lobenstine
“Fluorescence Detected Circular Dichroism: Verification and Applications to Proteins”
Position: Manager of Computers and Network, Chemistry Department, University of Rochester
- 1981 Diane DePrisco Albergo
“Solvent Effects on the Thermodynamics and Kinetics of Double Helix Formation in Nucleic Acids”
Position: Scientist at Abbott Laboratories, Irving, Texas
- 1982 Matthew Petersheim (deceased)
“Stabilization of Ribonucleic Acid Double Helices by 'Dangling' Bases: Optical and NMR Studies”
Position: Associate Professor and Chair of Chemistry, Seton Hall University, South Orange, NJ
- 1984 Catherine A. Harrison
“Photochemistry of Nucleic Acids Including Crosslinking to Proteins”
Subsequent position: Scientist at Eastman Kodak Company, Rochester, NY
- David R. Hickey
“Thermodynamic Effects of Solvent and Terminal Mismatches on Oligoribonucleotide Stability”
Position: Instructor, Department of Chemistry, University of Rochester
- 1985 Michael Lamos
“Fluorescence Detected Circular Dichroism of Ethidium-Nucleic Acid Complexes”
Subsequent Position: Scientist at Sienna Biotech, Stillwater, MN
- 1988 Alison Williams
“Raman Laser Temperature-Jump, Spectroscopic and Thermodynamic Studies of Salt Effects on Duplex Formation by dGCATGC”
Position: Vice President for Equity and Inclusion, Wesleyan University
- 1989 Carl Longfellow
“Thermodynamic and Spectroscopic Studies of Bulge Loop Structures Formed by Oligoribonucleotides”
Subsequent Position: Scientist at Wyeth-Ayerst Labs, Rouses Point, NY
- 1989 John Jaeger
“RNA Secondary Structure: Prediction, Melting, and Chemical Modification”
Subsequent Position: Information Technology Business Partner for Research, Bristol Myers Squibb
- 1991 John SantaLucia, Jr.
“The Role of Hydrogen Bonding in the Thermodynamics and Structure of Mismatches in RNA Oligonucleotides”

Positions:

Professor of Chemistry, Wayne State University, Detroit, MI
CEO, DNA Software, Ann Arbor, MI

1993 Adam E. Peritz

“Studies of Symmetric and Asymmetric Internal Loops in RNA”

Subsequent position: Staff member, Nucleic Acid Facility, University of Pennsylvania

Philip C. Bevilacqua

“Dynamics of Substrate-Ribozyme Interaction: Binding, Conformational Changes, and Catalysis”

Position: Professor of Chemistry (Department Chairman), Pennsylvania State University, University Park, PA

Liyan He

“Thermodynamic and Structural Studies of G•U Mismatches in RNA”

Subsequent position: Sr. Technology Commercialization and Liaison Officer at Weill Cornell Medical College, New York City

1994 Amy E. Walter (Morsch)

“Thermodynamic Studies of the Sequence Dependence of Stability for Interfaces of Coaxially Stacked Helixes and Tandem GA Mismatches in RNA”

Subsequent position: Programmer, A-LIFE Medical, Inc., San Diego, CA

Aloke Raj Banerjee

“Investigation of the Folding Pathway of a Group I Ribozyme: Melting, Chemical Modification and Kinetics Studies”

Subsequent position: Manager, Assay Research, Nanosphere

1996 Ming Wu

“Structure and Thermodynamic Stability of Symmetric Tandem Mismatches in RNA”

Subsequent position: Manager, Gilead Sciences Inc., Foster City, CA

Jeffrey A. McDowell

“Investigation of the Structural Basis of the Thermodynamic Stability of Symmetric, Tandem GU Mismatches in RNA”

Position: Senior Manager – The Janssen Pharmaceutical Companies of Johnson & Johnson, Greater Philadelphia Area

1997 James Kim

“The Thermodynamics of Coaxial Stacking and Its Effect on RNA Secondary Structure”

Position: Associate Professor of Internal Medicine, University of Texas Southwestern Medical School

Yi Li

“Effects of Temperature, Mg^{2+} and the 2' OH of Guanosine on Substrate Binding and Reactivity with the Tetrahymena Ribozyme”

Subsequent Position: Scientist, Alza Pharmaceuticals, Mountain View, CA

1998 Louis Profenno

“Conformational Rearrangements in the Catalytic Mechanism of the *Tetrahymena* Ribozyme”

Position: Psychiatrist, Syracuse, NY

- 1999 Tianbing Xia
“Sequence Dependence of Stabilities and Structures of Tandem Mismatches and Watson-Crick Base Pairs in RNA”
Position: Systems Engineer, Abbott Labs, Dallas
- 2000 Xiaoying Chen
“Stability and Structure of Guanosine-Uridine and Isoguanosine-Isocytidine Pairs”
Subsequent position: Manager, Bioinformatics, Roche Molecular Systems, Inc., Pleasanton, CA
- Mark E. Burkard
“Base Stacking Interactions and the Thermodynamics and Structure of Guanine-Guanine Pairs in RNA”
Position: Professor of Medicine and Oncology, University of Wisconsin, Madison
- 2001 David H. Mathews
“Prediction of RNA Secondary Structure”
Position: Maquat Distinguished Professor of RNA Biology, Department of Biochemistry and Biophysics, University of Rochester
- Thomas W. Barnes III
“The Impact of Long-Range Cooperativity, Base Composition and Structure on the Molecular Recognition of RNA by C5-(1-Propynyl) Pyrimidine-Containing Oligodeoxynucleotides”
Subsequent position: Patent Attorney, International Paper Co.
- 2002 Susan J. Schroeder
“Exploring the Thermodynamic Stabilities and Structures of Asymmetric Internal Loops in RNA”
Positions: Associate Professor, Departments of Chemistry and of Microbiology and Plant Biology, University of Oklahoma
- Matthew D. Disney
“*In vitro* and *in vivo* Targeting of RNA in Fungal Pathogens with Oligonucleotides and Small-Molecules”
Position: Professor of Chemistry, Scripps Research Institute - Florida
- 2003 Jessica Childs (Disney)
“Oligonucleotide Directed Misfolding of RNAs”
Position: Senior Staff Scientist, Chemistry Dept., Scripps Research Institute - Florida
- 2004 Brent Znosko
“Thermodynamic and Structural Properties of RNA Oligomers Containing Purine Rich Internal Loops and DNA:RNA Hybrids with C5-Propynyl Substitutions”
Position: Professor of Chemistry, St. Louis University
- 2005 Gang Chen
“Expanded Sequence Dependence Improves Prediction of RNA Internal Loop Stability and NMR Reveals Molecular Recognition Interactions Accounting for Stability, Structure and Dynamics”
Position: Associate Professor, School of Life and Health Sciences, The Chinese University of Hong Kong, Shenzhen

- 2006 Shenghua Duan
 “Applying Oligonucleotide Microarrays in Determining RNA Secondary Structure”
 Subsequent position: Bioinformatics Analyst II, Center for Cancer Computational Biology, Dana Farber Cancer Institute
- Blanton Tolbert
 “The Solution NMR Structures of Model RNA Duplexes Containing Non-Canonical GA Pairs: Insights into the Factors Affecting Thermodynamic Stability of RNA 2X2 Nucleotide Internal Loops”
 Position: Professor of Chemistry, Case Western Reserve University
- 2007 Neelaabh Shankar
 “NMR Studies of Two Conserved RNA Internal Loops Found in Ribosomes”
 Position: Patent Attorney
- 2008 Ilyas Yildirim
 “Free Energy Calculations of RNA Duplexes with Tandem GA Base Pairs Using the Thermodynamic Integration Approach”
 Position: Assistant Professor of Chemistry, Florida Atlantic University
- 2009 James M. Hart
 “NMR-Assisted Prediction of RNA Secondary Structure”
 Position: Medical Director at Abbott Core Diagnostics
- 2010 Ruiting Liang
 “RNA Secondary Structure Determination: Isoenergetic Oligonucleotide Microarray Compared with Chemical Mapping and MALDI MS Detection of Chemical Mapping”
 Position: Director, Analytical Research and Development, Beigene
- Biao Liu
 “Fluorescence Competition Assay Measurements of Thermodynamics for RNA Pseudoknots and Multibranch Loops”
 Position: Computational Scientist, Intellia Therapeutics, Cambridge MA
- 2011 Walter N. Moss
 “RNA Secondary Structure Discovery and Characterization”
 Position: Associate Professor of Molecular Biology and Biophysics, Iowa State University
- Nicolas Hammond
 “Investigating the mechanism of Hoechst 33258 inhibition of Candida spp. growth and II. RNA internal loops with tandem AG pairs: the structure of the 5’GAGU/3’UGAG loop can be dramatically different from others, including 5’AAGU/3’UGAA”
 Position: Assistant Director of University of Rochester Workshop Program
- 2013 Jason Tubbs
 “Computational and Experimental Advances in the RNA Therapeutic Pipeline”
 Position: Associate Director of Quality Operations, CoreRX, Clearwater, FL
- Salvatore Priore
 “Discovery and Characterization of Influenza Virus RNA Secondary Structures”
 Position: Assistant Professor of Clinical Pathology and Laboratory Medicine, Perelman School of Medicine, University of Pennsylvania

Indee Dela-Moss

“Analysis of RNA Secondary Structure: Common Themes in Spliced Segments of Influenza A, B, and C”

Subsequent Position: Postdoctoral Fellow, Iowa State University

2015

David Condon

“Nucleic Acid Force Fields in Prediction of Ensemble NMR Properties”

Position: Assistant Professor of Internal Medicine, University of South Dakota, Lead Computational Bioinformatics Analyst at Sanford Health, Sioux Falls, South Dakota

Jonathan Chen

“Two- and Three-Dimensional Modeling of RNA Structures with NMR and Thermodynamics Methods”

Position: Staff Scientist, Center for RNA Biology, University of Rochester Medical Center

Tian Jiang

“RNA Structure and Function of Influenza Virus”

Position: Systems Engineer, Abbott Labs, Dallas

2018

Kyle Berger

“Thermodynamic and Structural Studies of RNA Internal Loops Closed by GU Pairs”

Position: Postdoctoral Fellow in laboratory of David MacLean, University of Rochester School of Medicine and Dentistry

2019

Andrew Kauffmann

“Structures of RNA Sequences from Influenza”

Position: Assistant Professor of Chemistry, Truman State University, Missouri

2020

Jianbo Zhao

“Molecular Dynamics and Quantum Mechanics Studies of RNA Structures”

Position: Senior Scientist, Nested Therapeutics, Boston, MA

Visiting Scientists

Dr. Ryszard Kierzek, Professor, Institute of Bioorganic Chemistry, Poznan, Poland

Dr. Elzbieta Kierzek, Professor, Institute of Bioorganic Chemistry, Poznan, Poland

Dr. Peter Müller, Scientist, Dr. Karl Thomae, GmbH, Biebrach, Germany

Head, Department of Chemical Research, Dr. Karl Thomae, GmbH, Biebrach, Germany

Senior Vice President, Research and Development, Boehringer Ingelheim

Pharmaceuticals, Ridgefield, CT

Chief Scientific Officer & Senior Vice President, Vertex Pharmaceuticals

Retired

Dr. Martin J. Serra, Paul E. and Mildred L. Hill Professor of Chemistry, Allegheny College

Retired

Dr. Janet Morrow, Professor of Chemistry, SUNY at Buffalo

Dr. Neena Grover, Professor of Chemistry & Biochemistry, Colorado College