

CURRICULUM VITAE

Thomas R. Cech

Education and Training

B.A. in Chemistry, Grinnell College, Grinnell, Iowa 1970
Ph.D. in Chemistry, University of California, Berkeley
with Prof. John E. Hearst 1975
Postdoctoral Fellow, Dept. of Biology, Massachusetts Institute
of Technology with Prof. Mary Lou Pardue 1975-77

Positions

University of Colorado Boulder
Assistant Professor of Chemistry 1978-82
Associate Professor of Chemistry 1982-83
Professor of Chemistry and Biochemistry 1983-
Professor of Molecular, Cellular and Developmental Biology
(joint appointment) 1983-
American Cancer Society Professor 1987-
University of Colorado Anschutz Medical Campus
Professor of Biochemistry and Molecular Genetics
Member, CU Cancer Center 1988-
Investigator, Howard Hughes Medical Institute 1988-99; 2009-
University of Colorado Distinguished Professor 1990-
President, Howard Hughes Medical Institute 2000-09
Director, University of Colorado BioFrontiers Institute (formerly the
Colorado Initiative in Molecular Biotechnology) 2009-

Honors and Awards

National Science Foundation Graduate Fellow 1970-75
Public Health Service Research Fellow, National Cancer Institute 1975-77
Research Career Development Award, National Cancer Institute 1980-85
Passano Foundation Young Scientist Award 1984
Harrison Howe Award 1984
Guggenheim Fellow 1985-86
Pfizer Award in Enzyme Chemistry 1985
Esquire Magazine Register 1985
Denver Post Westerner of the Year 1986
U. S. Steel Award in Molecular Biology 1987
Member, National Academy of Sciences 1987
Honorary Degree, Doctor of Science, Grinnell College 1987
V. D. Mattia Award 1987
Member, American Academy of Arts and Sciences 1988
Newcombe-Cleveland Award, AAAS (with Arthur J. Zaugg) 1988
Heineken Prize, Royal Netherlands Academy of Sciences 1988
Gairdner Foundation International Award 1988
Louisa Gross Horwitz Prize (with Phillip A. Sharp) 1988
Albert Lasker Basic Medical Research Award (with Phillip A. Sharp) 1988
Lewis Rosenstiel Award, Brandeis Univ. (with Sidney Altman) 1989
Warren Triennial Prize, Harvard Medical School (with Joan Steitz) 1989
Nobel Prize in Chemistry 1989
Bonfils-Stanton Award for Science 1990
Honorary Degree, Doctor of Science, Univ. of Chicago 1991

Honors and Awards (continued)

Sir Frederick Gowland Hopkins Medal, British Biochemical Society	1992
Doctor of Science (honorary), Drury College, Springfield, MO,	1994
Ciba Geigy-Drew Award in Biomedical Research	1994
Feodor Lynen Medal	1995
National Medal of Science	1995
Mike Hogg Award, M. D. Anderson Cancer Center, Univ. of Texas	1997
Wright Prize, Harvey Mudd College	1998
Doctor of Science (honorary), Colorado College	1999
Doctor of Science (honorary), Univ. of Maryland Baltimore County	2000
Honorary Degree, Doctor of Science, Williams College	2000
Member, Institute of Medicine	2000
Member, American Philosophical Society	2001
Honorary Degree, Charles University, Prague, Czech Republic	2002
Gregor Mendel Medal, Czech Academy of Sciences	2002
Doctor of Science (honoris causa), Ohio State University	2003
Honorary Member of the NAS, Republic of Korea	2004
Rolf Sammet Prize, Goethe University, Frankfurt	2004
Honorary Doctor of Science, Moscow State University, Russia	2004
Honorary Doctor of Science, University of Vermont	2005
ASBMB Award for Exemplary Contribution to Education	2006
Othmer Gold Medal, Chemical Heritage Foundation	2007
Honorary Doctor of Science, University of Buenos Aires, Argentina	2007
Honorary Doctor of Science, Dartmouth College	2008
Lifetime Achievement Award, RNA Society	2009
Honorary Doctor of Science, Rockefeller University	2009
Lifetime Achievement Award, Colorado Bioscience Association	2009
Honorary Doctor of Science, Watson School of Biological Sciences, Cold Spring Harbor Laboratories, Cold Spring Harbor, NY	2010
Honorary Doctor of Science, Harvard University, Cambridge, MA	2010
Honorary Membership, Alpha Omega Alpha, Honor Medical Society	2011

Lectureships

Phillips Distinguished Visitor, Haverford College	1984
Vivian Ernst Memorial Lecture, Brandeis University	1984
Welch Foundation Symposium	1985
Danforth Lecture, Grinnell College	1986
Pfizer Lecture, Harvard University	1986
Verna and Marrs McLean Lecture, Baylor	1987
Harvey Lecture	1987
Cynthia Ann Chan Memorial Lectures, Berkeley	1987
Mayer Lecture in Life Sciences, M.I.T.	1987
Martin D. Kamen Distinguished Lectureship, UCSD	1988
Alfred Burger Lecture, University of Virginia	1988
Berzelius Lecture, Karolinska Institute, Stockholm	1988
Osamu Hayaishi Lecture, Int'l Union of Biochem., Prague	1988
The NIH Lecture	1988
Matrone Lectureship, North Carolina State University	1989
Beckman Lecture, University of Utah	1989
Abbott Visiting Scholar, University of Chicago	1989
HHMI Lecture, Massachusetts Institute of Technology	1989
Max Tishler Distinguished Lecture, Merck	1989
Herriott Lecture, Johns Hopkins	1990
J. T. Baker Lecture, University of Pennsylvania	1990
G. N. Lewis Memorial Lecture and Medal, Univ. Cal. Berkeley	1990

Lectureships (cont'd)

Sonneborn Lecture, Indiana University	1991
Sternbach Lectures, Yale University	1991
Irving Sigal Lecture, Merck Sharp & Dohme Research Labs	1991
Pauli Lectures, ETH, Zürich Switzerland	1992
Carter-Wallace Lectureship, Princeton	1992
A. Baird Hastings Lecture, Harvard Medical School	1992
DeWitt Stetten, Jr. Lecture, National Institutes of Health	1992
Hyp J. Dauben Lecture, University of Washington, Seattle	1992
Russell Marker Lectures, University of Maryland	1993
Hirschmann Lecture, Oberlin College	1993
Beach Family Lectures, Purdue University	1993
Abraham White Lecture, Syntex	1993
Staples Lectures, University of Maine	1993
Welch Foundation Symposium	1993
Fred J. Robbins Lectureship, Pomona College	1994
Leopold Marcus Memorial Lecture, Washington University, St. Louis	1994
T. Y. Shen Lecture, Massachusetts Institute of Technology	1994
Bren Fellows Program Lecture, University of California, Irvine	1994
Stanley Wawzonek Lecture, University of Iowa	1994
James B. Sumner Lecture, Cornell University	1994
Ewing Halsell Lecture, Univ. of Texas at San Antonio	1994
Capital Science Lecture, Carnegie Institution of Washington	1994
Five-College Chemistry Lectures, organized by Smith College	1994
Juan March Foundation Lecture, Madrid, Spain	1995
O'Leary Lectures, Gonzaga University	1995
Steenbock Lectures, University of Wisconsin, Madison	1995
Takashi Murachi Lecture, FAOB Congress, Sydney, Australia	1995
Streck Award for Contributions to Biochemistry, Univ. of Nebraska	1996
Gardner/Davern Laureate Lectures, The University of Utah	1996
Joseph Priestley Lectures, Pennsylvania State University	1996
Beckman Lecture, California Institute of Technology	1996
Eyring Lectures in Chemistry and Biochemistry, Arizona State Univ.	1997
Roy Moon Distinguished Lectureship in Science, Angelo State Univ.	1997
R. U. Lemieux Lecture on Biotechnology, University of Alberta	1997
DeCoursey Nobel Lectures, Trinity University	1998
Tschirgi Lecture, University of California, San Diego	1998
The Danish Society for Biochemistry and Molecular Biology Lecture, FEBS Silver Jubilee Mtg, Copenhagen	1998
George Boxer Memorial Lecture, Robert Wood Johnson Medical School	1998
Lloyd B. Thomas Lecture, University of Missouri	1999
Werner Bachmann Memorial Lecture, University of Michigan	1999
DuPont-Marshall Lecture, University of Pennsylvania	1999
National Institutes of Health Director's Lecture	2000
Feodor Lynen Lecture Mosbacher Kolloquium, Mosbach Germany	2001
The Morgenthaler Lectureship, Case Western Reserve University	2001
Tercentenary Silliman Lectures, Yale University	2001
Dan Nathans Lecture, Johns Hopkins University	2002
Tishler Prize Lecture, Harvard University	2002
Nelson Leonard Lectures, University of Illinois	2005
Carter-Wallace Lectures, Princeton University	2005
Jean Mitchell Watson Lecture, University of Chicago	2007
Montgomery Fellow Lecturer, Dartmouth College	2007
Harold Berger Distinguished Lecture, University of Pennsylvania	2008

Lectureships (cont'd)

Andrew Braisted Award Lectureship, UC Berkeley	2008
Baxter Lecture, Stanford University	2008
Haragan Lecture, Texas Tech University	2009
Leslie Orgel Lecture in Molecular Biology, Salk Institute	2009
Abraham Flexner Lecture, Discovery Lecture Series, Vanderbilt	2010
Distinguished Allman Lecture, SMU, Dedman College	2010
The St. Geme Lectureship, CU-Denver	2010
George H. Boyd Distinguished Lecture, University of Georgia, Athens	2011
The Bernard Axelrod Lectures in Biochemistry, Purdue University	2011
Richard A. Scott Lecture, Northwestern University	2011
Nina W. Matheson Lecture, AAMC Annual Meeting	2011
Distinguished Scientists Lecture, Trinity University, San Antonio, Texas	2012
Oliver Smithies Nobel Lecture, UNC, Chapel Hill, North Carolina	2012
Holt Memorial Lecture, MIT, Cambridge, Massachusetts	2013

Professional Societies

American Society of Biochemistry and Molecular Biology	
American Association for the Advancement of Science, Fellow	
Japanese Biochemical Society, Honorary Member	1990
European Molecular Biology Organization, elected Assoc. Member	1992
The RNA Society - Cofounder and President	1993
Academia Europaea, elected Foreign Member	1999

Editorial

Associate Editor, <i>Cell</i>	1986-87
Editorial Board, <i>Genes and Development</i>	1987-
Deputy Editor for Biological Sciences, <i>Science</i>	1990-99
Associate Editor, <i>RNA</i>	1994-

Scientific Advisory Boards

Somatogen, Boulder, CO	1986-95
U. S. Biochemical Corporation, Cleveland, OH	1987-92
Ribozyme Pharmaceuticals, Inc., Boulder, CO	1992-99
MiRagen Therapeutics, Boulder, CO	2009-11

Board of Directors

Merck, Inc., Whitehouse Station, NJ	2009-
Mount Desert Island Biological Laboratory	2009-

Organizing Scientific Meetings

International Conference on Ciliate Molecular Biology Pingree Park, CO	1981
Nucleic Acids Gordon Conference, co-chairperson	1984
Cold Spring Harbor Meeting on RNA Processing, co-organizer	1987
International Meeting on Biochemistry, Beijing China Advisory Committee	1987
UCLA Symposium on "Molecular Biology of RNA"	1988
Whitehead Symposium, M. I. T., co-organizer	1991
RNA Processing Meeting, Keystone, CO (co-organizer)	1992
Keystone Symposium on "Ribozymes,(co-organizer)	1995
Structure of Enzymes and Ribozymes, Table Ronde, Paris, co-organizer	1995
Symposium on Chemistry in Biology, The Salk Institute, La Jolla, CA	1998
University of Colorado First Annual BioFrontiers Symposium	2012
Keystone Symposium on Long Non-coding RNAs (co-organizer)	2014

Other National Service

Molecular Biology Study Section, NIH, 1983, 1984, 1987	
National Research Council Report on "Opportunities in Chemistry," contributor and reviewer	1983-84
National Research Council Report on "Research Opportunities in Biology," contributor and reviewer	1986-88
Scientific Advisory Committee, David and Lucile Packard Fellowships for Science and Engineering	1988-97
Project 2061, AAAS	1989
NIHGMS Council	
Class Membership Committee, Class II, NAS	1992-93
Class II Membership Committee, Am. Acad. Arts & Sciences	1993
Advisory Board, Center for the Molecular Biology of RNA, U. C. Santa Cruz	1993-
Board of Advisory Scientists, Whitehead Institute, Massachusetts Institute of Technology	1995-99
Chair of Selection Committee, Pharmacia Biotech/ <i>SCIENCE</i> Prize for Young Scientists	1995-99
Member, American Chemical Society Committee on Education	1997-
Non-Resident Fellow, The Salk Institute	1997-99
Board of Trustees, Grinnell College	1998-
Burroughs Welcome Career Awards Selection Committee	1998-99
National Academy of Sciences Class Membership Committee	1998-00
Advisory Committee to the Director, National Institutes of Health	1999-03
NAS Committee on Community Standards for Sharing Publication-Related Data and Materials (Chair)	2001-02
Biological Panel of the National Academy of Sciences' Committee on Science and Technology for Countering Terrorism	2002
NAS Committee "Bridges to Independence" (Chair)	2004-05
American Academy of Arts & Sciences Committee "ARISE" Advancing Research in Science and Engineering (Chair)	2008-09
Honorary Centennial Observance Committee of the Research Corporation for Science Advancement, Member	2011
Member of Advisory Committee, Kavli Foundation, Los Angeles, CA	2011
Vanderbilt Univ. Medical School, Dean's Advisory Comm.	2011-
Harvard Univ., Chair of Visiting Comm. for CMB Dept.	2012
Science, Technology & Policy Forum, Private meeting with Senators on Capitol Hill	2012

Public Service (selected activities, 1993-2012)

Commencement Address, University of California, Berkeley, May 23, 1993.	
Commencement Address, University of California, Davis, June 19, 1993.	
Given Institute Public Lecture, Aspen, CO, July 22, 1993.	
Morgan County Chapter, University of Colorado Alumni Association Ft. Morgan, CO, October 21, 1993.	
Keynote Address, ARCS Scholarship Banquet, Denver, CO, November 2, 1993.	
Colorado Skeptics, Luncheon Speech, Boulder, CO, April 1, 1994.	
International Baccalaureate, Keynote Speaker, Boulder Chapter Dinner, May 9, 1994.	
Keynote Address, Boulder High School Commencement, Boulder, CO, June 4, 1994.	
Featured Speaker, Rotary Club of Denver, CO, June 23, 1994.	
Keynote Speaker at National Honor Society Induction Ceremony, Fairview High School, September 19, 1994.	
Hosted visit by Broomfield High School AP Biology Class, January 1995.	
Mr. Wizard Presentation, Boulder, February 1995.	

Public Service, continued

Denver Area Gifted & Talented, Mr. Wizard Presentation, Merrill Middle Sch., Apr 1995
Seminar to High School Biology Teachers taking HHMI-sponsored course, July 1995.
Howard Hughes Medical Institute's Holiday Lectures on Science for high school students (four talks), satellite transmission to 8000 schools in U. S. and Canada, Chevy Chase, MD, December 18-19, 1995.
Hosted visit by Berthoud Elementary School, February 21, 1996.
Mr. Wizard Presentation, Boulder, February 24, 1996.
Master of Ceremonies at International Baccalaureate Fund-Raiser, May 11, 1996.
CU Alumni speech at CU Denver, February 20, 1997.
Boulder Valley Science Fair speech, March 8, 1997.
Taught High School Chemistry at Fairview High School, October 16 and 17, 1996.
Guest Speaker, Colorado Science and Engineering Fair, Ft. Collins, CO, April 11, 1997.
Master of Ceremonies, International Baccalaureate "Trivia Bowl" fundraiser, April 26, 1997.
Presentation to participants of the National Chemistry Olympiad Competition, U.S. Air Force Academy, June 21, 1997.
Mr. Wizard Presentation, Boulder, October 25, 1997.
Hosted Dawson School visit to laboratory and gave public lecture at evening event, October 27, 2000.
Rocky Mountain PBS Service Announcement, November 16, 2009.
Esprit Entrepreneur event for the Boulder Chamber and Economic Council: "The 25th year of Esprit where the spirit of entrepreneurship in Boulder is celebrated," August 19, 2009.
President's Leadership Class, Boulder Campus, September 15, 2009.
"An Insider's View: visions for the future of CIMB," (home of Jennifer and Aaron Kennedy), September 29, 2009.
Channel 4 interview, "Return to the Classroom," October 21, 2009.
Faculty 1st Year Graduate Student Talks, University of Colorado-Boulder, October 29, 2009.
CU Foundation Board of Trustees Presentation, University of Colorado-Boulder, October 30, 2009.
Butcher Symposium, "What's Happening at the End of Chromosomes?" Denver, CO, November 6, 2009.
Commencement Address, University of Colorado-Boulder, December 18, 2009.
Commencement Address, Watson School of Biological Sciences, Cold Spring Harbor Laboratories, April 25, 2010.
Miramontes Arts & Sciences Spring Undergraduate Colloquium, University of Colorado Boulder, January 25, 2012.
University of Colorado "Student for a Day," February 20, 2012
Boulder County Business Report's CEO Roundtable, April 17, 2012
University of Colorado "Admitted Student Day," April 14, 2012

PUBLICATIONS

1. Cech, T. R., Rosenfeld, A. and Hearst, J. E. Characterization of the Most Rapidly Renaturing Sequences in Mouse Main-band DNA. *J. Mol. Biol.* 81, 299-325 (1973).
2. Hearst, J. E., Cech, T. R., Marx, K. A., Rosenfeld, A. and Allen, J. R. Characterization of the Rapidly Renaturing Sequences in the Main CsCl Density

- Bands of *Drosophila*, Mouse, and Human DNA. *Cold Spring Harbor Symp. Quant. Biol.* 38, 329-339 (1973).
3. Cech, T. R. and Hearst, J. E. An Electron Microscopic Study of Mouse Foldback DNA. *Cell* 5, 429-446 (1975).
 4. Cech, T. R. and Hearst, J. E. Organization of Highly Repeated Sequences in Mouse Main-band DNA. *J. Mol. Biol.* 100, 227-256 (1976).
 5. Cech, T. R., Wieseahn, G. and Hearst, J. E. Partial Denaturation of Mouse DNA in Preparative CsCl Density Gradients at Alkaline pH. *Biochemistry* 15, 1865-1873 (1976).
 6. Wieseahn, G., Cech, T. R. and Hearst, J. E. A Study of DNA Denaturation in the Ultracentrifuge. *Biopolymers* 15, 1591-1613 (1976).
 7. Cech, T. R. and Pardue, M. L. Electron Microscopy of DNA Crosslinked with Trimethylpsoralen: A Test of the Secondary Structure of Eukaryotic Inverted Repeat Sequences. *Proc. Natl. Acad. Sci. USA* 73, 2644-2648 (1976).
 8. Cech, T. and Pardue, M.L. Crosslinking of DNA with Trimethylpsoralen is a Probe for Chromatin Structure. *Cell* 11, 631-640 (1977).
 9. Cech, T., Potter, D. and Pardue, M. L. Electron Microscopy of DNA Crosslinked with Trimethylpsoralen: A Probe for Chromatin Structure. *Biochemistry* 16, 5313-5321 (1977).
 10. Cech, T., Potter, D. and Pardue, M. L. Chromatin Structure in Living Cells. *Cold Spring Harbor Symp. Quant. Biol.* 42, 191-198 (1978).
 11. Berninger, M., Cech, T. R., Fostel, J., Potter, D., Scott, M. and Pardue, M. L. The Structure and Function of the Mitochondrial DNA of *Drosophila melanogaster*. *Alfred Benzon Symp.* (ed. by J. Engberg, H. Klenow, and V. Leick), Vol. 13, (1978).
 12. Cech, T., Pathak, M. A. and Biswas, R. K. An Electron Microscopic Study of the Photochemical Cross-linking of DNA in Guinea Pig Epidermis by Psoralen Derivatives. *Biochim. Biophys. Acta* 562, 342-360 (1979).
 13. Cech, T. and Rio, D. C. Localization of Transcribed Regions on the Extrachromosomal Ribosomal RNA Genes of *Tetrahymena thermophila* by R-loop Mapping. *Proc. Natl. Acad. Sci. USA* 76, 5051-5055 (1979).
 14. Zaug, A. J. and Cech, T. R. *In vitro* Splicing of the Ribosomal RNA Precursor in Nuclei of *Tetrahymena*. *Cell* 19, 331-338 (1980).
 15. Cech, T. R. and Karrer, K. M. Chromatin Structure of the Ribosomal RNA Genes of *Tetrahymena* as Analyzed by *in vivo* Trimethylpsoralen Crosslinking. *J. Mol. Biol.* 136, 395-416 (1980).
 16. Potter, D. A., Fostel, J. M., Berninger, M., Pardue, M. L. and Cech, T. R. DNA-protein Interactions in the *Drosophila melanogaster* Mitochondrial Genome as Deduced from Trimethylpsoralen Crosslinking Patterns. *Proc. Natl. Acad. Sci. USA* 77, 4118-4122 (1980).
 17. Cech, T. R. Alkaline Gel Electrophoresis of Deoxyribonucleic Acid Photoreacted with Trimethylpsoralen: Rapid and Sensitive Detection of Interstrand Cross-Links. *Biochemistry* 20, 1431-1437 (1981).
 18. Grabowski, P. J., Zaug, A. J. and Cech, T. R. The Intervening Sequence of the Ribosomal RNA Precursor is Converted to a Circular RNA in Isolated Nuclei of *Tetrahymena*. *Cell* 23, 467-476 (1981).
 19. Cech, T. R. and Brehm, S. L. Replication of the Extrachromosomal Ribosomal RNA Genes of *Tetrahymena thermophila*. *Nucleic Acids Res.* 9, 3531-3543 (1981).
 20. Cech, T. R., Zaug, A. J. and Grabowski, P. J. *In vitro* Splicing of the Ribosomal RNA Precursor of *Tetrahymena*: Involvement of a Guanosine Nucleotide in the Excision of the Intervening Sequence. *Cell* 27, 487-496 (1981).

21. Zaug, A. J. and Cech, T. R. The Intervening Sequence Excised from the Ribosomal RNA Precursor of *Tetrahymena* Contains a 5'-Terminal Guanosine Residue not Encoded by the DNA. *Nucleic Acids Res.* 10, 2823-2838 (1982).
22. Cech, T. R., Zaug, A. J., Grabowski, P. J. and Brehm, S. L. Transcription and Splicing of the Ribosomal RNA Precursor of *Tetrahymena*. In THE CELL NUCLEUS (H. Busch and L. Rothblum, eds.; Academic Press, NY) Vol. X, pp. 171-204 (1982).
23. Cech, T., Zaug, A., Grabowski, P. and Brehm, S. Processing of Ribosomal RNA. In RNA PROCESSING (S. J. Flint, ed.) *Fed. Proc.* 41, 2781-2789 (1982).
24. Kruger, K., Grabowski, P. J., Zaug, A. J., Sands, J., Gottschling, D. E. and Cech, T. R. Self-Splicing RNA: Autoexcision and Autocyclization of the Ribosomal RNA Intervening Sequence of *Tetrahymena*. *Cell* 31, 147-157 (1982).
25. Zaug, A. J., Grabowski, P. J. and Cech, T. R. Autocatalytic Cyclization of an Excised Intervening Sequence RNA is a Cleavage-Ligation Reaction. *Nature* 301, 578-583 (1983).
26. Palen, T. E. and Cech, T. R. Transcribed and Non-Transcribed Regions of *Tetrahymena* Ribosomal Gene Chromatin Have Different Accessibilities to Micrococcal Nuclease. *Nucleic Acids Res.* 11, 2077-2091 (1983).
27. Gottschling, D. E., Palen, T. E. and Cech, T. R. Different Nucleosome Spacing in Transcribed and Non-Transcribed Regions of the Ribosomal RNA Gene in *Tetrahymena thermophila*. *Nucleic Acids Res.* 11, 2093-2109 (1983).
28. Brehm, S. L. and Cech, T. R. Fate of an Intervening Sequence Ribonucleic Acid: Excision and Cyclization of the *Tetrahymena* Ribosomal RNA Intervening Sequence *in vivo*. *Biochemistry* 22, 2390-2397 (1983).
29. Cech, T. R., Tanner, N. K., Tinoco, I., Jr., Weir, B. R., Zuker, M. and Perlman, P. S. Secondary Structure of the *Tetrahymena* Ribosomal RNA Intervening Sequence: Structural Homology with Fungal Mitochondrial Intervening Sequences. *Proc. Nat. Acad. Sci. USA* 80, 3903-3907 (1983).
30. Cech, T. R. RNA Splicing: Three Themes with Variations (Minireview). *Cell* 34, 713-716 (1983).
31. Grabowski, P. J., Brehm, S. L., Zaug, A. J., Kruger, K. and Cech, T. R. Self-Splicing of the Ribosomal RNA Precursor of *Tetrahymena*. In GENE EXPRESSION (O. J. Hammer and M. J. Rosenberg, eds.; Alan R. Liss, N.Y.) Vol. 8, 327-342 (1983).
32. Pardue, M. L., Fostel, J. M. and Cech, T. R. DNA-Protein Interactions in the *Drosophila virilis* Mitochondrial Chromosome. *Nucleic Acids Res.* 12, 1991-1999 (1984).
33. Palen, T. E. and Cech, T. R. Chromatin Structure at the Replication Origins and Transcription Initiation Regions of the Ribosomal RNA Genes of *Tetrahymena*. *Cell* 36, 933-942 (1984).
34. Bass, B. L. and Cech, T. R. Specific Interaction Between the Self-Splicing RNA of *Tetrahymena* and its Guanosine Substrate: Implications for Biological Catalysis by RNA. *Nature* 308, 820-826 (1984).
35. Zaug, A. J., Kent, J. R. and Cech, T. R. A Labile Phosphodiester Bond at the Ligation Junction in a Circular Intervening Sequence RNA. *Science* 224, 574-578 (1984).
36. Gottschling, D. E. and Cech, T. R. Chromatin Structure of the Molecular Ends of *Oxytricha* Macronuclear DNA: Phased Nucleosomes and a Telomeric Complex. *Cell* 38, 501-510 (1984).
37. Inoue, T. and Cech, T. R. Secondary Structure of the Circular Form of the *Tetrahymena* Ribosomal RNA Intervening Sequence: A Technique for RNA

- Structure Analysis Using Chemical Probes and Reverse Transcriptase. *Proc. Natl. Acad. Sci. USA* 82, 648-652 (1985).
38. Cech, T. R. Self-Splicing RNA: Implications for Evolution. In GENOME EVOLUTION IN PROKARYOTES AND EUKARYOTES, *International Review of Cytology* 93, 3-22 (1985).
 39. Price, J. V., Kieft, G. L., Kent, J. R., Sievers, E. L. and Cech, T. R. Sequence Requirements for Self-Splicing of the *Tetrahymena thermophila* Pre-Ribosomal RNA. *Nucleic Acids Res.* 13, 1871-1889 (1985).
 40. Price, J. V. and Cech, T. R. Coupling of *Tetrahymena* Ribosomal RNA Splicing to β -Galactosidase Expression in *Escherichia coli*. *Science* 228, 719-722 (1985).
 41. Zaug, A. J. and Cech, T. R. Oligomerization of Intervening Sequence RNA Molecules in the Absence of Proteins. *Science* 229, 1060-1064 (1985).
 42. Sullivan, F. X. and Cech, T. R. Reversibility of Cyclization of the *Tetrahymena* rRNA Intervening Sequence: Implication for the Mechanism of Splice-Site Choice. *Cell* 42, 639-648 (1985).
 43. Tanner, N. K. and Cech, T. R. Self-Catalyzed Cyclization of the Intervening Sequence RNA of *Tetrahymena*: Inhibition by Intercalating Dyes. *Nucleic Acids Res.* 13, 7741-7758 (1985).
 44. Tanner, N. K. and Cech, T. R. Self-Catalyzed Cyclization of the Intervening Sequence RNA of *Tetrahymena*: Inhibition by Methidiumpropyl EDTA and Localization of the Major Dye Binding Sites. *Nucleic Acids Res.* 13, 7759-7779 (1985).
 45. Zaug, A. J., Kent, J. R. and Cech, T. R. Reactions of the Intervening Sequence of the *Tetrahymena* Ribosomal Ribonucleic Acid Precursor: pH Dependence of Cyclization and Site-Specific Hydrolysis. *Biochemistry* 24, 6211-6218 (1985).
 46. Been, M. D. and Cech, T. R. Sites of Circularization of the *Tetrahymena* rRNA IVS are Determined by Sequence and Influenced by Position and Secondary Structure. *Nucleic Acids Res.* 13, 8389-8408 (1985).
 47. Inoue, T., Sullivan, F. X. and Cech, T. R. Intermolecular Exon Ligation of the rRNA of *Tetrahymena*: Oligonucleotides Can Function as 5' Exons. *Cell* 43, 431-437 (1985).
 48. Cech, T. R. The Generality of Self-Splicing RNA: Relationship to Nuclear mRNA Splicing. *Cell* 44, 207-210 (1986).
 49. Zaug, A. J. and Cech, T. R. The Intervening Sequence RNA of *Tetrahymena* Is an Enzyme. *Science* 231, 470-475 (1986).
 50. Burke, J. M., Irvine, K. D., Kaneko, K. J., Kerker, B. J., Oettgen, A. B., Tierney, W. M., Williamson, C. L., Zaug, A. J. and Cech, T. R. Role of Conserved Sequence Elements 9L and 2 in Self-Splicing of the *Tetrahymena* Ribosomal RNA Precursor. *Cell* 45, 167-176 (1986).
 51. Inoue, T., Sullivan, F. X. and Cech, T. R. New Reactions of the Ribosomal RNA Precursor of *Tetrahymena* and the Mechanism of Self-splicing. *J. Mol. Biol.* 189, 143-165 (1986).
 52. Cech, T. R. and Bass, B. L. Biological Catalysis by RNA. *Ann. Rev. Biochem.* 55, 599-629 (1986).
 53. Cech, T. R. A Model for the RNA-catalyzed Replication of RNA. *Proc. Natl. Acad. Sci. USA* 83, 4360-4363 (1986).
 54. Garriga, G., Lambowitz, A. M., Inoue, T. and Cech, T. R. Mechanism of Recognition of the 5' Splice Site in Self-splicing Group I Introns. *Nature* 322, 86-89 (1986).
 55. Bass, B. L. and Cech, T. R. Ribozyme Inhibitors: Deoxyguanosine and Dideoxyguanosine Are Competitive Inhibitors of Self-Splicing of the *Tetrahymena* Ribosomal Ribonucleic Acid Precursor. *Biochemistry* 25, 4473-4477 (1986).

56. Zaug, A. J. and Cech, T. R. The *Tetrahymena* Intervening Sequence Ribonucleic Acid Enzyme Is a Phosphotransferase and an Acid Phosphatase. *Biochemistry* 25, 4478-4482 (1986).
57. Cech, T. R. Ribosomal RNA Gene Expression in *Tetrahymena*: Transcription and RNA Splicing. In THE MOLECULAR BIOLOGY OF CILIATED PROTOZOA (J. G. Gall, Ed., Academic Press: New York) pp. 203-225 (1986).
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311. Goldfarb, K.C., Borah, S., Cech, T.R. RNase P branches out from RNP to protein: organelle-triggered diversification? *Genes Dev.* 10, 1005-1009 (2012).
312. Nandakumar, J., Bell, C.F., Weidenfeld, I., Zaug, A.J., Leinwand, L.A., Cech, T.R. The TEL patch of telomere protein TPP1 mediates telomerase recruitment and processivity. *Nature*, 492: 285-289 (2012).
313. Schwartz, J.C., Ebmeier, C.C., Podell, E.R., Heimiller, J., Taatjes, D.J., Cech, T.R. FUS binds the CTD of RNA polymerase II and regulates its phosphorylation at Ser2. *Genes Dev.* 26: 2690-95 (2012).
314. Nandakumar, J., Cech, T.R. Finding the end: recruitment of telomerase to telomeres. *Nature Reviews Molecular Cell Biology*, 14: 69-82 (2013).
315. Dalby, A.B., Goodrich, K.J., Pflingsten, J.S., Cech, T.R. RNA recognition by the DNA end-binding Ku heterodimer. *RNA* 6: 841-851 (2013). PMID: PMC3683917
316. Zaug, A.J., Crary, S.M., Fioravanti, M.J., Campbell, K., Cech, T.R. Many disease-associated variants of hTERT retain high telomerase enzymatic activity. *Nucleic Acids Res.* In Press (2013).

Editorials, Commentaries and Policy Reports

Cech, T. R. A Celebration of Life in the Trenches. *Science* 268, 15 (1998).

Cech, T. R. Science at Liberal Arts Colleges: A Better Education? *Daedalus* 128, 195-216 (1999).

Cech, T. R. Biology's Revolution: Opportunities and Challenges for Universities. Research Universities and the Future of the Academic Disciplines, Proceedings from the Centennial Meeting of the Association of American Universities, University of Chicago, October 16, 2000.

Cech, T. R. and Leonard, J. S. Conflicts of Interest — Moving Beyond Disclosure. *Science* 291, 989 (2001).

Cech, T. R. Working Together in the Biology Revolution. *The Chronicle of Higher Education*, Point of View, B24, February 16, 2001.

Cech, T. R. Inefficient Teaching — We Need More Of It. *ASBMB News*, March/April, 2001.

Cech, T. R. Rebalancing Teaching and Research. *Science* 299, 165 (2003).

Cech, T.R. (Chair of Committee) – “Sharing Publication-Related Data and Materials,” Report of the National Research Council, (2003).

Cech, T. R. and Bond, E. C. Managing Your Own Lab. *Science* 304, 1717 (2004).

Cech, T. R. and Rubin, G. M. Nurturing Interdisciplinary Research. *Nature Structural & Molecular Biology* 11, 1166-1169 (2004).

Cech, T.R. Fostering Innovation and Discovery in Biomedical Research. *JAMA* 294, 1390-1393, (2005).

Cech, T.R. (Chair of Committee) - “Bridges to Independence: Fostering the Independence of New Investigators in Biomedical Research,” Report of the National Research Council, (2005).

Cech, T.R. and Kennedy, D. Doing More for Kate. *Science* 310, 1741, (2005).

Cech, T.R. Twenty-Five Years of Ribozymes (Foreword). *RNA v-ix*, (2007).

Andrews, N., Burriss, J.E., Cech, T.R. et al., Translational Careers. *Science* 323, 1646, (2009).

Cech, T.R. How a Chemist Looks at RNA. *Angewandte Chemie, International Edition*, online 3 DEC 2012 [ahead of press] (2012).

Other Publications from the Cech Research Group

Dinter-Gottlieb, G. Viroids and Virusoids are Related to Group I Introns. *Proc. Natl. Acad. Sci. USA* 83, 6250-6254 (1986).

Price, J. V. Origin of the Phosphate at the Ligation Junction Produced by Self-splicing of *Tetrahymena thermophila* Pre-ribosomal RNA. *J. Mol. Biol.* 196, 217-221 (1987).

Williamson, J. R. and Celander, D. W. Rapid Procedure for Chemical Sequencing of Small Oligonucleotides Without Ethanol Precipitation. *Nucleic Acids Res.* 18, 379 (1990).

Nazar, R. N. Higher Order Structure of the Ribosomal 5S RNA. *J. Biol. Chem.* 266, 7 (1991).

Herschlag, D. Implications of Ribozyme Kinetics for Targeting the Cleavage of Specific RNA Molecules *In Vivo*. More Isn't Always Better. *Proc. Natl. Acad. Sci. USA* 88, 6921-6925 (1991).

Herschlag, D. Evidence for Processivity and Two-Step Binding of the RNA Substrate from Studies of J1/2 Mutants of the *Tetrahymena* Ribozyme. *Biochemistry* 31, 1386-1399 (1992).

Doudna, J. A., Grosshans, C., Gooding, A., and Kundrot, C. E. 1993. Crystallization of Ribozymes and Small RNA Motifs by a Sparse Matrix Approach. *Proc. Natl. Acad. Sci. USA* 90, 7829-7833 (1993).

Campbell, T. B., McDonald, C. K. and Hagen, M. The Effect of Structure in a Long Target RNA on Ribozyme Cleavage Efficiency. *Nucleic Acids Res.* 25, 4985-4993 (1997)

Podell, E. R., Harrington, D. J., Taatjes, D. J. and Koch, T. H. Crystal Structure of Epidoxorubicin-formaldehyde Virtual Crosslink of DNA and Evidence for Its Formation in Human Breast-Cancer Cells. *Acta Crystallographica* D55, 1516-1523 (1999).

Talks Presented

1. Department of Biochemistry, University of Copenhagen, Denmark, September 13, 1977.
2. Department of Molecular Biology, University of Aarhus, Denmark, September 20, 1977.
3. Animal Cells and Viruses Gordon Conference, Tilton NH, June 26-30, 1978.
4. Ciliate Genetics and Cell Biology Meeting, Santa Barbara CA, July 15-18, 1979.
5. Cornell University, October 2, 1979.
6. University of Rochester, October 4, 1979.
7. Brandeis University, October 9, 1979.
8. Massachusetts Institute of Technology, October 10, 1979.
9. University of Colorado Medical Center, Denver CO, November 5, 1979.
10. University of Utah Medical Center, Salt Lake City UT, March 17, 1980.
11. Iowa State University, Ames, April 18, 1980.
12. Colorado State University, Ft. Collins CO, May 1, 1980.
13. Nucleic Acids Gordon Conference, June 9, 1980.
14. Carnegie Institute of Washington, April 10, 1981.
15. Meeting on Nucleic Acid Processing, Frederick Cancer Center, April 11.
16. University of California, Berkeley, May 18, 1981.
17. University of California, Irvine, May 21, 1981.
18. ASBC Meeting, Mini-symposium on RNA Processing, St. Louis, June 2, 1981.
19. Ciliate Molecular Biology Meeting, Pingree Park CO, August 18, 1981.
20. Cold Spring Harbor Laboratory, N.Y (Invited talk given by graduate student Paula Grabowski) August 22, 1981.
21. MCD Biology, University of Colorado, Boulder, September 22, 1981.
22. University of Colorado, Medical Center, Denver, November 4, 1981.
23. Washington University, St. Louis, January 18, 1982.
24. Indiana University, Bloomington, January 19, 1982.

25. University of Illinois, Urbana, February 24, 1982.
26. Northwestern University, Evanston, IL, February 25, 1982.
27. University of Chicago, February 26, 1982.
28. RNA Processing Meeting, Cold Spring Harbor Laboratory (invited speaker) May 19-23, 1982.
29. Nucleic Acids Gordon Conference (speaker and chairman of session on RNA Processing) June 13-28, 1982. Elected co-chairman of the conference for 1984.
30. Biological Regulatory Mechanisms Gordon Conference (invited speaker) June 20-25, 1982.
31. Animal Cells and Viruses Gordon Conference (invited talk given by graduate student Paula Grabowski) June 20-25, 1982.
32. Chromatin Gordon Conference (invited talk given by professional research assistant, Arthur Zaugg) June 28-July 2, 1982.
33. School of Pharmacy, University of Colorado, October 6, 1982.
34. Colorado School of Mines, Golden, October 12, 1982.
35. Yale University, November 15, 1982.
36. Sidney Farber Cancer Institute, Boston (Visiting Faculty for Tumor Cell and Molecular Biology course), November 16, 1982.
37. Massachusetts Institute of Technology, November 16, 1982.
38. Harvard University, November 18, 1982.
39. California Institute of Technology, November 30, 1982.
40. University of California, San Francisco, January 10, 1983.
41. University of California, Berkeley, January 11, 1983 (Series of two seminars, one in Chemistry and one in Biochemistry).
42. Stanford University, January 12, 1983.
43. University of Nevada, Reno, January 27, 1983.
44. Eleanor Roosevelt Institute for Cancer Research, Denver, January 31, 1983.
45. Synergen Associates, Inc., Boulder, February 28, 1983.
46. CETUS-UCLA Symposium on Gene Expression (Plenary Lecture), Park City UT, April 1, 1983.
47. UCLA Symposium on Mechanisms of DNA Replication and Recombination (Plenary Lecture and Session Chairman) Keystone CO, April 9, 1983.
48. Cold Spring Harbor Meeting on RNA Processing (Session Chairman), May 18, 1983.
49. Nucleic Acids Gordon Conference, June 16, 1983.
50. Summer Symposium in Molecular Biology, Penn State University, July 27, 1983.
51. Ciliate Molecular Biology Meeting (Session Chairperson), Pingree Park CO, August 15, 1983.
52. University of British Columbia, Vancouver, September 12, 1983.
53. Hutchison Cancer Research Center, Seattle, September 14, 1983.
54. University of Oregon, Eugene, September 15, 1983.
55. Johns Hopkins, Baltimore MD, October 12, 1983.
56. UCLA (Biology Department Seminar and evening talk to the Evolutionary Group), November 16, 1983.
57. University of California, San Diego, January 18, 1984.
58. National Institutes of Health, March 6, 1984.
59. Haverford College, Phillips Distinguished Visitor, March 21-23, 1984.
60. Vivian Ernst Memorial Lecture, Brandeis University, April 25, 1984.
61. RNA Processing Meeting, Cold Spring Harbor Laboratory, Chairperson for session on RNA Catalyzed Reactions and speaker, May 16, 1984.
62. American Society of Biological Chemists Meeting, Minisymposium on RNA Processing, St. Louis, June 6, 1984.

63. Gordon Research Conference on Enzymes, Coenzymes and Metabolic Pathways, July 2-6, 1984.
64. Danish Biochemical Society, Copenhagen, August 16, 1984.
65. University of Lund, Sweden, August 20, 1984.
66. Uppsala University, Sweden, August 22, 1984.
67. Swedish Biochemical Society, Stockholm, August 25, 1984.
68. Rochester Section of the American Chemical Society, Harrison Howe Award Lecture, November 7, 1984.
69. University of Rochester, November 8, 1984.
70. Cornell University, Ithaca NY, November 9, 1984.
71. Combined Seminar of the University of Texas, Rice University and Baylor, Houston TX, December 13, 1984.
72. UCLA Symposium on Nuclear Envelope Structure and RNA Maturation, Steamboat Springs CO, January 14, 1985.
73. University of Wisconsin, Madison, Two seminars, January 31 and February 1, 1985.
74. Carnegie-Mellon University, February 20, 1985.
75. University of Pittsburgh, February 21, 1985.
76. Colorado State University, March 7, 1985.
77. Duke University, March 27, 1985.
78. University of North Carolina, March 28, 1985.
79. Cetus-UCLA Symposium on Sequence Specificity in Transcription and Translation, Steamboat Springs CO, April 3, 1985.
80. American Society of Biological Chemists annual meeting, Symposium on RNA Splicing (Chairman and Speaker), Anaheim CA, April 25, 1985.
81. New York State Department of Health, Albany NY, June 5, 1985.
82. Fourth Conversation in Biomolecular Stereodynamics, Albany NY, June 6, 1985.
83. NATO Advanced Research Workshop, 3 D Structure of RNA, Keynote Address, Renesse, The Netherlands, August 23, 1985.
84. International Congress of Biochemistry, Amsterdam, August 28, 1985.
85. American Chemical Society Annual Meeting, (Pfizer Award Lecture), Chicago IL, September 10, 1985.
86. National Foundation for Cancer Research Annual Meeting, Woods Hole MA, September 12, 1985.
87. Symposium on New Perspectives in Nucleic Acids, Keynote Address, Bloomington IN, September 29, 1985.
88. Origin of Life Symposium, California Institute of Technology, October 15, 1985.
89. California Institute of Technology, Department of Chemistry, October, 15, 1985.
90. Welch Foundation Symposium, Houston TX, November 4-6, 1985.
91. Hutchinson Cancer Center, Seattle WA, December 3, 1985.
92. Structural Biology Symposium, Berkeley CA, January 15, 1986.
93. University of California, San Francisco CA, January 20, 1986.
94. University of California, Davis CA, January 21, 1986.
95. University of California, Berkeley CA, January 22, 1986.
96. University of Kansas, Lawrence KS, February 13, 1986.
97. University of Arizona, Tucson AZ, March 10, 1986.
98. UCLA Symposium on Transcriptional Control, Keystone CO, April 11, 1986.
99. "Perspectives in Biochemical Catalysis," National Advisory General Medical Sciences Council Symposium, NIH, May 14, 1986.
100. "A Molecular View of Evolution," Rutgers NJ, May 15, 1986.
101. Cold Springs Harbor RNA Processing Meeting, NY, May 17, 1986.
102. "New Perspectives on the Molecular Biology of RNA," Fifth Stony Brook Symposium, Stony Brook NY, May 19, 1986.

103. Nucleic Acids Gordon Conference, Session Chairman and Speaker, June 8-11, 1986.
104. Aspen M.D.-Ph.D. Student Conference, Aspen CO, July 21, 1986.
105. "RNA Enzymes and the Origin of Life," University of Colorado Alumni Association 90 Minutes, Faculty Lecture Series, September 3, 1986.
106. Carleton College, September 22, 1986.
107. University of Minnesota, annual student-sponsored speaker, September 24, 1986.
108. Grinnell College, Danforth Lectureship, September 25, 1986.
109. Endocrinology Department, University of Colorado Health Sciences Center, Denver, November 4, 1986.
110. Harvard University, Pfizer Lecture in honor of Konrad Bloch, November 7, 1986.
111. International Symposium of Gene Expression, Kyoto, Japan, November 19, 1986.
112. Mitsubishi-Kasei Institute of Life Sciences, Tokyo, Japan, December 1, 1986.
113. Molecular Biology Society of Japan and the Genetic Society of Japan, joint annual meeting, 1 of 2 plenary lecturers, Nagoya, Japan, December 4, 1986.
114. Stanford University, January 30, 1987.
115. University of California, San Diego, January 21, 1987.
116. 15th Annual Verna and Marris McLean Lecture, Baylor College of Medicine, February 4-6, 1987.
117. National Institutes of Health, February 18, 1987.
118. Eleanor Roosevelt Institute for Cancer Research, Denver, March 2, 1987.
119. Albert Einstein College of Medicine, Bronx NY, March 19, 1987.
120. Harvey Lecture, Rockefeller University NY, March 19, 1987.
121. Colorado Section Award Lecture, American Chemical Society, Denver, March 24, 1987.
122. 4th Annual Cynthia Ann Chan Memorial Lectures, Berkeley, April 20 and 22, 1987.
123. Distinguished Faculty Seminar, University of Colorado, School of Medicine, April 29, 1987.
124. RNA Processing Meeting, Cold Spring Harbor Laboratory NY, May 16, 1987.
125. Cold Spring Harbor Symposium on Quantitative Biology, Session chair and speaker, Cold Spring Harbor NY, May 29, 1987.
126. American Society of Biological Chemists Meeting, plenary lecture, Philadelphia PA, June 9, 1987.
127. University of Pennsylvania, June 9, 1987.
128. International Meeting on Biochemistry, plenary lecture, Beijing, China, August 18, 1987.
129. New Jersey School of Medicine and Dentistry, Newark, September 30, 1987.
130. Roche Institute of Molecular Biology, Nutley NJ, V. D. Mattia Award Lecture, October 1, 1987.
131. Massachusetts Institute of Technology, Mayer Lecture in Life Sciences, November 10, 1987.
132. U. S. Biochemical Corporation, Cleveland OH, December 7, 1987.
133. University of Oregon Health Sciences Center, Portland, January 15, 1988.
134. Salk Institute, La Jolla CA, February 3, 1988.
135. Martin D. Kamen Distinguished Lectureship, University of California, San Diego, February 4, 1988.
136. Colorado State University, Ft. Collins, February 25, 1988.
137. Alfred Burger Lecture, University of Virginia, Charlottesville, March 10, 1988.
138. UCLA Symposium on Molecular Biology of RNA, Keystone CO, April 9, 1988.
139. National Academy of Sciences, Washington DC, April 25, 1988.
140. Berzelius Lecture, Karolinska Institute, Stockholm, May 26, 1988.
141. Heineken Award Lecture, Royal Netherlands Academy of Arts and Sciences, Amsterdam, May 30, 1988.

142. RNA Symposium, Leiden University, The Netherlands, May 31, 1988.
143. Institute de la Vie International Conference "From Theoretical Physics to Biology," Versailles, France, July 5, 1988.
144. Osamu Hayaishi Lecture, International Union of Biochemistry Meeting, Prague, Czechoslovakia, July 15, 1988.
145. Albany Conference on RNA: Catalysis, Splicing, Evolution (Keynote address), Rensselaerville NY, September 22-25, 1988.
146. University of California, Berkeley, October 6, 1988.
147. University of Toronto (Two talks), October 20, 1988.
148. Columbia University, Horwitz Prize Lecture, November 1, 1988.
149. National Institutes of Health, NIH Lecture, November 2, 1988.
150. Department of Pediatrics, University of Colorado Health Sciences Center, Basic Science Symposium, Denver, November 11, 1988.
151. Honors Program Lecture, New York University School of Medicine, November 17, 1988.
152. 26th Annual Briefing NEW HORIZONS IN SCIENCE, Council for the Advancement of Science Writing, Inc., Boulder, November 30, 1988.
153. Eleanor Roosevelt Institute, Denver, January 6, 1989.
154. North Carolina State University, Matrone Lectureship, January 12, 1989.
155. Duke University, January 13, 1989.
156. University of Texas Southwestern Medical Center, Dallas, University Lecture Series (2 lectures), February 8-10, 1989.
157. Beckman Lecture, University of Utah, Salt Lake City, February 22, 1989.
158. California Institute of Technology, March 1, 1989.
159. Symposium on Frontiers of Science, Beckman Center, Irvine CA, March 2-4, 1989.
160. Paul Karrer Centennial Symposium, University of Zürich, Switzerland, March 17, 1989.
161. UCLA Symposium on DNA Replication, Keystone CO, March 30, 1989.
162. HHMI Conference, Airlie VA, April 9-12, 1989.
163. Rosenstiel Award Lecture, Brandeis University, April 24, 1989.
164. Leermakers Symposium, Wesleyan University, Middletown CT, May 9, 1989.
165. Bristol-Myers, Wallingford CT, May 10, 1989.
166. Nucleic Acids Gordon Conference, Session Chairperson and Speaker, June 12-16, 1989.
167. Squibb, Princeton NJ, July 12, 1989.
168. Smith-Kline-French, July 13, 1989.
169. Aspen Basic/Clinical Science Conference, Aspen CO August 15-18, 1989.
170. Merck, Rahway NJ, Max Tishler Distinguished Lectureship, October 11, 1989.
171. Warren Triennial Lecture, Massachusetts General Hospital, Boston, October 11, 1989.
172. HHMI Lecture, Massachusetts Institute of Technology, October 12, 1989.
173. CRCW Distinguished Research Lectureship, University of Colorado, Boulder, November 6, 1989.
174. Abbott Visiting Scholar, University of Chicago, 3 lectures, November 13-17, 1989.
175. Nobel Prize Lecture, Royal Academy of Sciences, Stockholm, December 8, 1989.
176. Uppsalla University, December 12, 1989.
177. Lund University, December 14, 1989.
178. University of Colorado Health Sciences Center, Denver, Keynote Address, January 11, 1990.
179. Winter Seminar, Klosters, Switzerland, January 14, 1990.
180. University of California, Davis, February 6, 1990.
181. University of Iowa, Iowa City IA, February 22, 1990
182. HHMI Meeting, Airlie VA, March 12, 1990.
183. California State Polytechnic University, Pomona CA, April 19, 20, 1990.

184. Cold Spring Harbor RNA Processing Meeting, NY (Session Chair and Speaker), May 18, 1990.
185. RNA Symposium, Free University of Amsterdam, The Netherlands, May 21, 1990.
186. CU-Syntex Synthetic Chemistry Symposium, University of Colorado, Boulder, June 7, 1990.
187. 23rd Reactions Mechanism Conference, University of Colorado, Boulder, June 14, 1990.
188. American Academy of Achievement, Chicago, June 28-30, 1990.
189. University of California, Santa Cruz (two lectures), July 26, 27, 1990.
190. FASEB Meeting, Copper Mountain CO (Session Organizer and Speaker), August 15, 1990.
191. Japan Society of Biochemistry, Osaka, September 14, 1990.
192. Nagase Research & Development Center, Kobe, Japan, September 17, 1990.
193. University of California, San Francisco, October 4, 1990.
194. Johnson Symposium, Stanford University, October 5, 1990.
195. American Cancer Society Research Professors Meeting, Key Largo, FL (Session chairman), October 11-13, 1990.
196. International Conference on Catalytic RNA as an Anti-HIV Agent (Keynote address), San Diego, CA, October 22, 1990.
197. Scripps Institute, San Diego, CA, October 23, 1990.
198. Herriott Lectureship, Johns Hopkins, Baltimore, MD, November 14, 1990.
199. Baker Lecture, University of Pennsylvania, Philadelphia, November 15, 1990.
200. Lewis Lectures, University of California, Berkeley, December 1-4, 1990.
201. UCLA Symposium on Antisense Nucleic Acids, Keystone, CO, February 2-7, 1991.
202. University of Arizona, Tucson, February 18, 1991.
203. Grinnell College, 2 Lectures, March 7, 1991.
204. Iowa State University, Life Sciences Symposium, Keynote Address, March 8-9, 1991.
205. Sonneborn Lecture, Indiana University, Bloomington, March 19, 1991.
206. Frontiers in Chemistry and Frontiers in Biology lectures, Case Western Reserve Univ. Cleveland, March 20-21, 1991.
207. Leo Sternbach Lectures, Yale University, April 3, 1991.
208. Colorado College, Colorado Springs, April 17, 1991.
209. American Society for Biochemistry and Molecular Biology Meeting, Keynote Address, Atlanta, GA April 25, 1991.
210. Krug Lectures, University of Illinois, Champaign-Urbana, May 1, 1991.
211. Carleton College Convocation, May 3, 1991.
212. Nucleic Acids Gordon Conference, session chair and speaker, June 9-13, 1991.
213. University of Chicago, June 14, 1991.
214. Irving Sigal Lecture, Merck Sharp & Dohme Research Laboratories, July 11, 1991.
215. RNA-Protein Interactions, Urbino, Italy, September 20-27, 1991.
216. Biology, Ethics, and the Origins of Life, Colorado State University, September 29, 1991.
217. Whitehead Symposium, M. I. T., Keynote Address and Co-organizer, October 6-8, 1991.
218. HHMI Conference, NIH, Bethesda, MD, October 13-16, 1991.
219. American Society of Hematology, Presidential Symposium, Denver, December 10, 1991.
220. Winter Seminar, Klosters, Switzerland, January 12, 1992.
221. Pauli Lectures, ETH Zurich, Switzerland, January 13-16, 1992
222. Biozentrum, Basel, Switzerland, January 16, 1992
223. Clayton Foundation Biochemical Institute Regents Lecturer, University of Texas-Austin, 2 lectures, February 3-5, 1992.
224. Frontiers in Biomedical Research, Rancho Mirage, CA, February 18-20, 1992.

226. HHMI Conference on Structural Biology, NIH, Bethesda, MD, February 23-26, 1992.
227. Carter-Wallace Lectures, Princeton University, 3 lectures, April 14-17, 1992.
228. 4th Conf. of Council on Undergraduate Research, Keynote Address, Hope College, Holland, MI, June 11, 1992.
229. Molecular Genetics Gordon Conference, Session chair and speaker, Newport, RI, July 13-17, 1992.
230. Hopkins Lecturer, British Biochemical Society, Glasgow, September 17, 1992.
231. EMBO Symposium, Heidelberg, September 21, 1992.
232. Harvard University, October 21, 1992.
233. Baird Hastings Lecture, Harvard Medical School, October 22, 1992.
234. DeWitt Stetten, Jr. Symposium, NIH, Bethesda, October 28, 1992.
235. National Association of Biology Teachers National Convention, Denver, CO, November 13, 1992.
236. Dauben Lecture and Seminar, University of Washington, November 19 and 20, 1992.
237. Dean's Intercampus Seminar, CU HSC, Denver, January 11, 1993.
238. Enzyme Mechanisms Conference, Key Largo, FL, January 6-8, 1993.
239. Nucleic Acids Medical Applications Conference, Cancun, Mexico, Keynote Address, January 26, 1993.
240. CU Health Sciences Center School of Dentistry, Keynote Address for Research Day, February 3, 1993.
241. Allergan, Inc., Irvine, CA, February 5, 1993.
242. Russell Marker Lectures, University of Maryland, February 9-11, 1993.
243. Fort Lewis College, Durango, CO, February 26, 1993.
244. Keystone Symposium on Nucleases, Session Chair and Speaker, Tammaron, CO, February 28, 1993.
245. Hirschmann Lecture, Oberlin College, Oberlin, OH, March 10, 1993.
246. National ACS Meeting, Bioinorganic Chemistry Symposium and Eminent Chemist speech to undergraduates, Denver, CO, March 29, 1993.
247. Beach Family Lectures, Purdue University, West Lafayette, IN, April 6-8, 1993.
248. University of Colorado, Denver, CO, April 16, 1993
249. Pasteur Institute, Paris, April 20, 1993.
249. COGENE Symposium, Paris, April 21-23, 1993.
250. Dedication of HHMI Headquarters, Chevy Chase, MD, May 5, 1993.
251. Commencement Address, University of California, Berkeley, May 23, 1993.
252. ASBMB/ACS Division of Biological Chemistry Meeting, San Diego, CA, Plenary Lecture, May 31, 1993.
253. Abraham White Lecture, Syntex, Palo Alto, CA, June 15, 1993.
254. Commencement Address, University of California, Davis, June 19, 1993.
255. Staples Lectures, University of Maine, Orono, ME, June 28-July 1, 1993.
256. Given Institute Anniversary Symposium plus Public Lecture, Aspen, CO, July 19-22, 1993.
257. HHMI Conference on Protein-Protein and Protein-Nucleic Acid Interactions, Chevy Chase, MD, September 19-22, 1993.
258. EPO Biology, History and Philosophy of Science Committee, Boulder, CO, September 30, 1993.
259. Frederick Cancer Center Symposium, Frederick, MD, October 12, 1993.
260. Welch Foundation Symposium, Houston, TX, October 25-26, 1993.
261. National Cancer Institute Symposium "Views to and from Macromolecular Structure," Frederick, MD, October 12, 1993.
262. Morgan County Chapter, University of Colorado Alumni Association, Ft. Morgan, CO, October 21, 1993.
263. Keynote Address, ARCS Scholarship Banquet, Denver, CO, November 2, 1993.

264. Partners In Science Conference, Tucson, AZ, January 17-18, 1994.
265. Forum on Science in the National Interest, Washington, DC, January 31, February 1, 1994.
266. Robbins Lectures (three talks), Pomona College, Claremont, CA, February 15-18, 1994.
267. Leopold Marcus Memorial Lecture, Washington University, Department of Chemistry, St. Louis, MO, February 28, 1994.
268. T. Y. Shen Lectures (two talks), Massachusetts Institute of Technology, Cambridge, MA, April 5, 6, 1994.
269. 131st Annual Meeting, National Academy of Sciences, Awards Ceremony, Washington, DC, April 15, 1994.
270. RNA Processing Meeting, University of Wisconsin, Madison, WI, May 24-29, 1994.
271. Department of Microbiology and Molecular Genetics, College of Medicine, University of California, Irvine, CA, Graduate Student Seminar, June 7, 1994.
272. The Bren Fellows Program Lecture, University of California, Irvine, CA, June 7, 1994.
273. Iowa City Area Science Center FORUM, Luncheon Speaker, Iowa City, IA, September 26, 1994.
274. The Stanley Wawzonek Lecture, Department of Chemistry, University of Iowa, Iowa City, IA, September 26, 1994.
275. Class of 1942 James B. Sumner Lecturer (two talks), Cornell University, Ithaca, NY, October 5-6, 1994.
276. Ciba Drew Symposium "Frontiers in Biomedical Research," Drew University, Madison, NJ, October 10, 1994.
277. Drury College Convocation Program, Springfield, MO, October 19, 1994.
278. Ewing Halsell Lecture, The University of Texas Health Science Center, San Antonio, TX, November 29, 1994.
279. HHMI Conference on Functional Insights from Structural Analyses, Chevy Chase, MD, November 13-16, 1994.
280. Five-College Chemistry Lecture Series (five talks), Amherst College, Hampshire College, Mount Holyoke College, Smith College, and the University of Massachusetts, November 1-4, 1994.
281. Capital Science Lecture, Carnegie Institution, Washington, DC, November 15, 1994.
282. Keystone Symposium. Ribozymes: Basic Science and Therapeutic Applications, Co-organizer, Breckenridge, CO, January 15-21, 1995.
283. Metals in Biology Gordon Conference. Ventura, CA, January 23, 1995.
284. Lynen Lecture, Miami Bio/Technology Winter Symposia, February 4-7, 1995.
285. O'Leary Lecture, Gonzaga University, Spokane, WA February 20-23, 1995.
286. Juan March Foundation Lecture, Madrid, Spain, March 6, 1995.
287. HHMI Conference on DNA, RNA and Protein Interactions, March 19-22, 1995.
288. University of Maryland Baltimore County, Department of Chemistry, March 21, 1995.
289. Steenbock Lectures in Biochemistry, University of Wisconsin, Madison, April 10-11, 1995.
290. Undergraduate Research Symposium, Keynote Speaker, Colorado State University, Ft. Collins, May 4, 1995.
291. Table Ronde Roussel UCLAF #80, "Structural basis of enzymatic activity in enzymes and ribozymes" Co-organizer and Speaker, Paris, France, May 11-12, 1995.
292. Nucleic Acids Gordon Conference, Speaker and Session Chair, New Hampton, NH, June 11-16, 1995.
293. Louis Pasteur International Symposium, Speaker, The Rockefeller University University, New York, NY, September 12-15, 1995.
294. 7th FAOB Congress, Takashi Murachi Memorial Lecture (Plenary lecture), Sydney, Australia, September 24, 1995.

295. Symposium on Catalytic Activities of RNA, Speaker, Sydney, Australia, September 26, 1995.
296. Seventh Annual Glaxo/UNC Symposium, "Frontiers in Chemistry and Medicine," Speaker, Chapel Hill, NC, November 7, 1995.
297. Department of Microbiology, Duke University, Durham, NC, Graduate Student Seminar, November 7, 1995.
298. 5th National Conference on the Education and Employment of Graduate Teaching Assistants, Plenary Speaker, Denver, CO, November 9, 1995.
299. Howard Hughes Medical Institute's Holiday Lectures on Science for high school students (four talks), Chevy Chase, MD, December 18-19, 1995.
300. The Streck Award for Contributions to Biochemistry and Clinical Chemistry, University of Nebraska, Lincoln, February 2, 1996.
301. Grinnell College Sesquicentennial Celebration, Grinnell, IA, February 15, 1996.
302. Gardner/Davern Laureate Lectures (three talks), The University of Utah, March 4-6, 1996.
303. HHMI Conference on The Structural Analysis of Protein-Protein and Protein-Nucleic Acid Interactions, Chevy Chase, MD, March 17-20, 1996.
304. Joseph Priestley Lecture Series in the Chemical Sciences (three talks), Pennsylvania State University, University Park, PA, April 9-11, 1996.
305. The Scripps Research Institute, La Jolla, CA, April 23, 1996.
306. 1996 Beckman Lecture, California Institute of Technology, Pasadena, CA, April 24, 1996.
307. 1996 Institute of Molecular Biology Symposium, (two talks), Academia Sinica, Nankang, Taipei, Taiwan, Republic of China, May 20-22, 1996.
308. RNA Society '96 Meeting, Session Chair and Speaker, Madison, WI, May 28-June 2, 1996.
309. 13th ACS Rocky Mountain Regional Meeting, Keynote Speaker, Lakewood, CO, June 11, 1996.
310. Max-Planck-Institut für Experimentelle Medizin, Göttingen, Germany, July 5, 1996.
311. Oxford University, Oxford, England, July 7, 1996.
312. Medical Research Council, Laboratory of Molecular Biology, Cambridge, England, July 9, 1996.
313. Sixth International Symposium on Reaction Mechanisms, Plenary Lecture, University of Kent, Canterbury, England, July 10, 1996.
314. Geron Telomerase and Cancer Symposium, Speaker, Kamuela, HI, August 10-14, 1996.
315. 20th IUPAC Symposium on the Chemistry of Natural Products, Nobel Laureate Lecture, Chicago, IL, September 19, 1996.
316. Whitehead Institute Retreat, Speaker, Waterville Valley, NH, September 20-22, 1996.
317. Banbury Conference on Telomeres and Telomerase, Cold Spring Harbor, NY, November 3-5, 1996.
318. University of Chicago graduate student sponsored speaker, lectures in Biochemistry and Cell Biology, January 8-9, 1997.
319. Eyring Lectures, Arizona State University, February 12-14, 1997.
320. Imperial Cancer Research Fund, London, U. K., February 24, 1997.
321. CIBA Foundation Symposium on Telomeres and Telomerase and open meeting at the Wellcome Centre for Medical Science, London, U. K., February 25-28, 1997.
322. R. U. Lemieux Lecture on Biotechnology, Univ. of Alberta, Edmonton, Canada, March 11, 1997.
323. Roy Moon Distinguished Lectureship, Angelo State University, San Angelo, TX, March 17-19, 1997.

324. Mike Hogg Award Lecture, M. D. Anderson Cancer Center, Houston, TX, March 19, 1997.
325. Vail Foundation Lecture, March 24, and talk at Vail Mountain School, March 25, 1997.
326. HHMI Conference on The Cell Cycle and Its Control, Chevy Chase, MD, April 6-9, 1997.
327. American Society of Microbiology Annual Meeting, Keynote Address, Miami, FL, May 4, 1997.
328. Conference on RNA Structure, Santa Cruz, CA, June 26, 1997.
329. National Medical Student Training Program Conference, Aspen, CO, July 13, 1997.
330. Stille Science Symposium, Colorado State University, Ft. Collins, CO, September 10, 1997.
331. Harvard University, Department of Molecular and Cellular Biology, September 18, 1997.
332. Kumamoto Institute of Technology, Kumamoto, Japan (2 lectures) November 10, 11, 1997.
333. Kyoto University, Kyoto, Japan, November 14, 1997.
334. Stanford University, January 14, 1998.
335. University of California, Berkeley, January 15, 1998.
336. Cal State Long Beach, Odyssey Program, February 18, 1998.
337. California Institute of Technology, February 19, 1998.
338. HHMI Scientific Meeting, Chevy Chase, MD, March 8-11, 1998.
339. DeCoursey Nobel Lectures, Trinity University, San Antonio, TX, April 6-8, 1998.
340. Tschirgi Lecture, University of California San Diego, April 17, 1998.
341. Salk Institute Annual Meeting, Keynote Lecture, La Jolla, CA, April 20, 1998.
342. Commencement address, "Vital Contradictions," University of Colorado, Boulder, May 15, 1998.
343. The Danish Society for Biochemistry and Molecular Biology Lecture, FEBS Silver Jubilee Meeting, Copenhagen, Denmark, July 5, 1998.
344. Geron Symposium II: Telomerase and Telomere Dynamics in Cancer and Aging. Maui, Hawaii, August 8-12, 1998.
345. George Boxer Memorial Lecture, Robert Wood Johnson Medical School, University of Medicine and Dentistry of New Jersey, Piscataway, NJ, September 24, 1998.
346. Princeton Fall Chemistry Symposium. Princeton, NJ, September 25, 1998.
347. Symposium on Research Opportunities in the Liberal Arts. "Research at Liberal Arts Colleges: A Scientist's View." Grinnell College, Grinnell, IA, October 10, 1998.
348. HHMI-NIH Cloister Scholars Lecture. HHMI Cloisters, Bethesda, MD, October 19, 1998.
349. HHMI Headquarters Lecture, Chevy Chase, MD, October 20, 1998.
350. 1998 Welch Conference on "The New Biochemistry: Macromolecular Machines." Houston, TX, October 26, 1998.
351. CU Health Sciences Center, Denver, CO, November 3, 1998.
352. Beckman Research Institute of the City of Hope, Duarte, CA, November 9, 1998.
353. Harvey Mudd College, Wright Prize Lecture, Claremont, CA, November 10, 1998.
354. 1998 San Diego Conference of the American Association for Clinical Chemistry. Keynote address. San Diego, CA, November 19, 1998.
355. Georgia Institute of Technology, Atlanta, GA, December 2, 1998.
356. Clayton College, Atlanta, GA (two talks), December 3, 1998.
357. University of California, San Francisco, Biophysics Program, January 7, 1999.
358. University of Oklahoma Health Sciences Center, Oklahoma City, OK, "Advanced Topics in Human Molecular Genetics," Distinguished Lecturer, January 26-27, 1999.
359. NIH Workshop on Chromatin, Transcription and DNA Replication. Washington, DC, February 3, 1999.

360. Cherry Creek School District Science Teachers "Eisenhower Night." Greenwood Village, CO, February 11, 1999.
361. Lloyd B. Thomas Lecture, University of Missouri (two talks). Columbia, MO, February 15-16, 1999.
362. HHMI Scientific Meeting on the Cell Cycle, Chevy Chase, MD, March 7-10, 1999.
363. National Commission on Undergraduate Research annual meeting, Keynote address and departmental seminar, University of Rochester, NY, April 8-9, 1999.
364. U. S. Congress House Subcommittee on Appropriations, presented testimony, April 28, 1999.
365. Werner E. Bachman Memorial Lecture, University of Michigan, Ann Arbor, MI, May 19, 20, 1999.
366. Nucleic Acids Gordon Conference (speaker and chairman of session on RNA and Processing) July 4-9, 1999.
367. 37th International Union of Pure and Applied Chemistry General Meeting, Invited Speaker, Berlin Germany, August 14-19, 1999.
368. Boston Structural Biology Seminar Series, Harvard Medical School, September 16, 1999.
369. DuPont-Marshall Lecture, University of Pennsylvania, Philadelphia, PA, October 13, 1999.
370. Institute of Medical Science, University of Tokyo-Novartis Symposium "RNA-Protein Interaction: From Basic Discoveries to Clinical Applications," Invited Speaker, Tokyo, Japan, November 8, 1999.
371. Tokyo Institute of Technology, Graduate School of Bioscience and Biotechnology, Tokyo, Japan, November 9, 1999.
372. Kumamoto Institute of Technology, Kumamoto, Japan, November 10-11, 1999.
373. Biomolecular Engineering Research Institute, Osaka, Japan, November 12, 1999.
374. National Academy of Sciences, Institute of Medicine, Distinguished Leaders in Sciences Lecture, Washington, DC, January 20, 2000.
375. Beckman Symposium, California Institute of Technology, April 7, 2000.
376. University of Maryland, Baltimore County Spring Commencement, Baltimore, MD, May 25, 2000.
377. National Institutes of Health Director's Lecture, Bethesda, MD, September 20, 2000.
378. Invited Speaker, Dedication Ceremony, Williams College, Williamstown, MA September 22, 2000.
379. Association of American Universities Centennial Symposium, University of Chicago, Chicago, IL, October 16, 2000.
380. HHMI Scientific Meeting on the Macromolecules and Molecular Machines, Chevy Chase, MD November 12-15, 2000.
381. National Human Genome Research Institute, Bethesda, MD, November 16, 2000.
382. The 28th Annual Calbiochem Lectureship Series, La Jolla, CA, February 28 and March 1, 2001.
383. American Society for Biochemistry and Molecular Biology Meeting, Plenary Commencement Address, Orlando, FL, March 31, 2001.
384. EMBL Distinguished Visitor Lecture, Heidelberg, Germany, April 4, 2001.
385. Feodor Lynen Lecture, Mosbacher Kolloquium, Mosbach Germany, April 5-7, 2001.
386. George Washington University Annual Research Day, Plenary Speaker, Washington, DC, April 20, 2001.
387. FASEB Board of Directors Meeting, Bethesda, MD, May 8, 2001.
388. HHMI Scientific Meeting on Mammalian Genetics & Physiological Genomics, Chevy Chase, MD, May 6-9, 2001.

389. 2001 Yale Chemical Biology Symposium Departments of Molecular, Cellular and Developmental Biology; Chemistry; and Molecular Biophysics and Biochemistry, Yale University, New Haven, CT, May 25, 2001.
390. Marvin Caruthers Symposium, Speaker, University of Colorado, Boulder, CO, June 22, 2001.
391. The Morgenthaler Lectureship, Case Western Reserve University, Cleveland, OH, September 19, 2001.
392. AAAS Advancing Science Seminar Series, The Impact of Genomics and Proteomics on Medicine. Washington, DC, September 25, 2001.
393. Tercentenary Silliman Lectures, Yale University, New Haven, CT, September 28-29, 2001.
394. Life Sciences Symposium, "A Look Ahead V: Futures in Biomedical Research," University of Maryland, Baltimore County, Baltimore, MD, November 1, 2001.
395. University of Maryland, College Park, MD, seminar speaker, December 4, 2001.
396. Daniel Nathans Lecture in Molecular Genetics, Johns Hopkins University School of Medicine, Department of Molecular biology and Genetics, Baltimore, MD, January 31, 2002.
397. Max Tishler Prize, Harvard University, Department of Chemistry and Chemical Biology, Cambridge, MA, two lectures, March 11, 12, 2002.
398. Richard M. Furlaud Distinguished Lecture, The Rockefeller University, New York City, NY, March 29, 2002.
399. AAMC Council of Deans Spring Meeting, "New Biology and New Medicine – Views from the Trenches and from the Sky," Savannah, GA, April 20, 2002.
400. AAMC GREAT/GRAND Meeting, "Interdisciplinary Research – Stories Small and Large," Denver, CO, April 26, 2002.
401. Ribozymes and RNA Catalysis, EMBO Workshop, Dundee, Scotland, August 23-26, 2002.
402. University of Colorado, Department of Molecular, Cellular and Developmental Biology, Seminar, Boulder, September 19, 2002.
403. NIGMS Workshop "Visions of the Future," Bethesda, MD, September 23, 2002.
404. HHMI Scientific Meeting on Computational and Structural Analysis of Biological Molecules. Speaker: "Evolution of Tetrahymena Ribozyme Mutants with Increased Structural Stability," Chevy Chase, MD, September 23, 2002.
405. 2002 National Conference of the Society for Advancement of Chicanos and Native Americans in Science (SACNAS). "The Biomedical Research Community: Views from HHMI," Anaheim, CA, September 27, 2002.
406. Project Kaleidoscope Faculty for the 21st Century National Assembly. Speaker: "Undergraduate Teaching: A View from the Trenches and from HHMI," Washington, DC, October 11, 2002.
407. Charles University, "RNA as an Enzyme: Structure and Mechanism," Prague, Czech Republic, October 16, 2002.
408. Institute of Organic Chemistry and Biochemistry, Institute of Molecular Genetics, "Life at the End of the Chromosome: Telomeres and Telomerase," Dejvice, Czech Republic, October 18, 2002.
409. Butcher Forum. Speaker: "CU's Strengths and Future," Westminster, CO, November 1, 2002.
410. Annual Biomedical Research Conference for Minority Students (ABRCMS). Speaker: "RNA as an Enzyme," New Orleans, LA, November 14, 2002.
411. Biology of RNA Meeting, "Before the DNA world: Life with an extra OH," Cold Spring Harbor Laboratory, NY, March 1, 2003.
412. James Stacy Coles Scholar and Lecturer, "Where the Double Helix Ends: Telomeres and Telomerase," Bowdoin College, Brunswick, ME, March 27, 2003.

413. Public Talk, "RNA as an Enzyme: Clues to the Origin of Life?" Bowdoin College, Brunswick, ME, March 28, 2003.
414. Thirty-eighth George Gamow Memorial Lecture, "From Catalytic RNA to Howard Hughes," University of Colorado, Boulder, April 2, 2003.
415. Biovision Nobel Day, "Where the Double Helix Ends: Telomeres and Telomerase," Lyon, France, April 8, 2003.
416. National Institutes of Health, Fogarty International Center's 35th Anniversary Symposium, May 21, 2003.
417. Princess Margaret Hospital, "Life at the End of the Chromosome: Protection of Telomeres," Toronto, Canada, September 11, 2003.
418. HHMI Scientific Meeting, Speaker: "DNA Self-recognition in the Protection of Telomeres Protein-ssDNA Complex," Chevy Chase, MD, September 23, 2003.
419. Ohio State University Research Lecture Series, "From Catalytic RNA to Howard Hughes," Columbus, OH, October 1, 2003.
420. Dartmouth College, "Life at the End of the Chromosome: the Telomeric DNA-protein Complex," Hanover, NH, October 6, 2003.
421. AAAS Lecture, "Small Science, Big Science — Laying the Foundation for Tomorrow's Medicine," Washington, DC, October 14, 2003.
422. Kyoto University, "Caps at the Ends of the Chromosome," Kyoto, Japan, November 11, 2003.
423. Nobel Prize Forum, "Caps at the Ends of the Chromosome," Kumamoto University, Japan, November 13, 2003.
424. Sammet-Guest Professorship, J. W. Goethe University, Frankfurt, Germany, 4 lectures: "RNA Enzymes and the Origin of Life," "Chromosome Telomeres: Structure and Function," "DNA Replication at the End of the Chromosome: RNA meets Protein," and "Interdisciplinary Science for the 21st Century: The Howard Hughes Medical Institute," January 27-29, 2004.
425. RNA Maxi Group, "Protection of Telomeres: Protein Recognition of Single-stranded Nucleic Acids," University of Wisconsin, Madison, WI, February 23, 2004.
426. Wisconsin Alumni Research Foundation, "How Best to do Research in the 21st Century and Janelia Farm Research Campus," University of Wisconsin, Madison, WI, February 24, 2004.
427. Chemistry of Life Processes Inaugural Symposium, "Folded Nucleic Acids — Beyond the Double Helix," Northwestern University, Evanston, IL, April 19, 2004.
428. NIH Symposium — A Decade of Neuroscience Informatics: Looking Ahead, "Sharing Neuroscience Data: Responsibilities and Challenges," Bethesda, MD, April 26, 2004.
429. Keynote Address, "From Catalytic RNA to Howard Hughes," Grinnell College, June 4, 2004.
430. Diploma of Doctor of Moscow State University, Russia. Two lectures, "RNA Catalysis: Chemistry and Structure," June 22, 2004; "Life at the End of the Chromosome," June 23, 2004.
431. HHMI International Research Scholars Meeting, "Structure of Human Telomeres: Molecular Basis for Chromosome End-Protection and Telomerase Inhibition," Tallinn, Estonia, June 23, 2004.
432. Genomics Teaching Place Grand Opening, University of Colorado, "Genes and Genomes — Implications for Evolution, Medicine and CSI," Boulder, July 29, 2004.
433. Nobel Symposium, "Life at the end of the Chromosome: Structure and Function of Human telomeres," Tallberg, Sweden, October 11, 2004.
434. Swarthmore College, two lectures, "RNA Enzymes and the Origins of Life" and "HHMI and Undergraduate Science Education," November 4, 2004.
435. HHMI Scientific Meeting, November 15-17, 2004.

436. Butcher Symposium, "The End of the Human Chromosome: Bioinformatics, Genetics & Structural Biology" University of Colorado, November 11, 2004.
437. Biozentrum, University of Basel, two lectures, "RNA Enzymes and the Origins of Life" and "Life at the End of the Chromosome: Structure and Function of Human Telomeres," Basel Switzerland, February 7-8, 2005.
438. HHMI Scientific Meeting, "Human Telomere Structure & Function," March 7-9, 2005.
439. RNA Symposium, "Yeast Telomerase RNA: a Flexible Scaffold for Proteins," University of California, San Diego, CA, April 1, 2005.
440. Seminar, Stowers Institute, "RNA Enzymes and the Origins of Life," Kansas City, MO, April 6, 2005.
441. Leonard Lectures, "RNA Enzymes and the Origins of Life," and "Life at the End of the Chromosome: Telomeres and Telomerase," University of Illinois at Urbana-Champaign, IL, April 18-19, 2005.
442. Grinnell College, Keynote Address, Undergraduate Research Symposium, "RNA as an Enzyme: Clues to the Origins of Life," Grinnell, IA, April 30, 2005
443. Seminar, "Telomerase and its Regulation-Biochemistry and Structure," The Rockefeller University, July 15, 2005
444. Carter Wallace Lecturer, "RNA as an Enzyme: Mechanism, Structure and Implications for the Origins of Life." and "Life at the End of the Chromosome: Telomeres and Telomerase," Princeton University, October 25-26, 2005.
445. Seminar, "Telomerase Reverse Transcriptase: Discovery, Biochemistry and a Cancer Vaccine," University of Colorado Cancer Center, November 8, 2005.
446. Keynote speaker, "Biotech Futures: Nationally and in Colorado," Colorado BioScience Association Annual Awards Dinner, Denver, November 8, 2005.
447. Keynote speaker, "Telomerase: from Basic Science to a Candidate for a Cancer Vaccine," American Cancer Society Celebrating Progress: 60 Years of Research Dinner, Washington, D.C., January 26, 2006.
448. Keynote speaker, "Telomerase: from Basic Science to a Candidate for a Cancer Vaccine," American Cancer Society Celebrating Progress: 60 Years of Research Dinner, Washington, D.C., January 26, 2006.
447. Keynote speaker, "Telomerase: from Basic Science to a Candidate for a Cancer Vaccine," American Cancer Society Celebrating Progress: 60 Years of Research Dinner, Washington, D.C., January 26, 2006.
448. Speaker, "A Look into the Future," Titans of Technology meeting, Reston, Virginia, February 1, 2006.
449. Seminar, "Telomerase: Discovery, Biochemistry and a Cancer Vaccine," University of Michigan, Ann Arbor, Michigan, February 9, 2006.
450. Keynote speaker, "Small Science, Big Science: Laying the Foundation for Tomorrow's Medicine," University of Michigan, Ann Arbor, Michigan, February 9, 2006.
451. ASBMB Education Award Lecture, "Always a Teacher, Always a Student," ASBMB Annual Meeting, San Francisco, April 2, 2006
452. Seminar, "Telomerase: where Protein meets RNA meets DNA," UCSF, April 3, 2006.
453. Speaker, "Crystal Structure of an Essential Telomerase-Specific Domain of TERT," ASBMB Annual Meeting, San Francisco, California, April 4, 2006.
454. Marion Koshland Lecture, "Telomerase: where Protein meets RNA meets DNA," University of California, Berkeley, April 4, 2006.
455. Keynote speaker, "Small Science, Big Science: Laying the Foundation for Tomorrow's Medicine," University of Chicago Dedication of Center for Integrative Sciences, Chicago, Illinois, April 26, 2006.
456. Seminar, "Telomerase: where DNA meets RNA meets Protein," University of Chicago, Chicago, Illinois, April 27, 2006.
457. Keynote presentation at Biojudiciary Meeting, Washington, D.C., May 18, 2006.

458. Speaker, "RNA as a flexible scaffold for proteins: yeast telomerase and beyond," Cold Spring Harbor Symposium on Regulatory RNAs, New York, June 3, 2006.
459. Speaker, "Big Science, Small Science & Some Recent Science," Perspectives in Science Seminar Series at Fred Hutchinson Cancer Center, Seattle, WA, June 22, 2006.
460. Seminar, "Telomeres and Telomerase, Structure and Regulation," University of Iowa, Iowa City, IA, October 13, 2006.
461. Keynote speaker, "From Catalytic RNA to the Howard Hughes Medical Institute," Missouri Valley Chapter, Society of Nuclear Medicine, Coralville, IA, October 14, 2006.
462. Speaker, "The Aviator - New Approaches to Biomedical Research," Young President's Organization, Washington, D.C., November 9, 2006.
463. Speaker, "Nurturing the Teacher-Scholar: the HHMI Professors Program," The Reinvention Center Conference, Washington, D.C., November 10, 2006.
464. Keynote speaker, "Nurturing the Physician-Scientist" The Dana-Farber Cancer Institute Visiting Committees, Boston, MA, November 15, 2006.
465. Keynote speaker, "Science without Borders," The American Society for Cell Biology, San Diego, CA, December 9, 2006.
466. Keynote speaker, "Telomerase: DNA meets RNA meets Protein," Institute of Biotechnology Celebration, Cocoyoc, Mexico, February 8, 2007.
467. HHMI Scientific Meeting, "Exploring the Flexible Scaffold Model for Yeast Telomerase RNA," Chevy Chase, MD, February 12-14, 2007.
468. Seminar, "Catalytic Activity of RNAs," Howard University, Washington, D.C., March 15, 2007.
469. Jean Mitchell Watson Lecturer, "RNA Enzymes and the Origin of Life," University of Chicago, April 24, 2007.
470. Session Chair, Telomeres and Telomerase Meeting, Cold Spring Harbor Laboratory, May 3, 2007.
471. Othmer Gold Medal Award, "The Interface between Chemistry and Biology, Chemical Heritage Foundation, Philadelphia, May 17, 2007.
472. Keynote Lecture, "From the RNA World to the RNP World," RNA 2007, University of Wisconsin, May 29, 2007.
473. Speaker, "Opportunities and Challenges of Large-Scaled Biomedical Science-HHMI Perspective," FASEB Symposium, Bethesda, Maryland, June 4, 2007.
474. Speaker, "Where Chemistry Meets Biology: View from the Trenches and from HHMI," NIH Training Summit Meeting, Bethesda, MD, June 21, 2007.
475. The Boylan Memorial Lecture "RNA Enzymes and the Origins of Life", Mt. Desert Island Biological Laboratory, Salisbury Cove, Maine, August 1, 2007.
476. Keynote, NSF Workshop "Excellence Empowered by a Diverse Academic Workforce: Achieving Racial & Ethnic Equity in Chemistry," Arlington, VA September 25, 2007
477. Keynote address, Mid Atlantic Bio Conference, Bethesda, Maryland, October 26, 2007.
478. 2007 The Montgomery Fellow Lecturer, "Exploring the Edges between Scientific Disciplines," Dartmouth College, October 29-30, 2007.
479. Robert G. Petersdorf Lecture "Finding the Balance in Research", AAMC Annual Meeting, Washington, D.C., November 5, 2007.
480. Lecture at the School of Sciences, "RNA Enzymes and the Origins of Life," University of Buenos Aires, November 19, 2007.
481. Opening Lecture, Meeting on Gene Expression and RNA Processing, Bariloche, Argentina, November 26, 2007.
482. Speaker, Council of Scientific Society Presidents, Washington D.C., December 3, 2007.

483. Harold Berger Distinguished Lecture "Mixing it up: Two tales of multidisciplinary research," University of Pennsylvania, Philadelphia, PA, January 31, 2008.
484. Andrew Braisted Award Lectureship "Telomerase: Collaboration of RNA and Protein," UC Berkeley, March 3, 2008.
485. Baxter Lecture "Telomerase-bipartisan Effort by RNA and Protein to Extend Chromosome Ends," Stanford University, March 4, 2008.
486. New York Academy of Sciences "New Vistas" presentation, March 11, 2008.
487. HHMI International Scholars Meeting, Lisbon, Portugal, June 18-22, 2008.
488. Aarhus, Denmark, June 25-26, 2008.
489. Packard Foundation, Park City, UT, September 4-6, 2008.
490. Frontiers of Translational Research Symposium, Harvard-MIT, Broad Institute, Cambridge, MA, September 25, 2008
491. Grinnell College seminar, Grinnell, IA, October 3, 2008.
492. Academy of Science Coating Ceremony, Dominion High School, Sterling, VA, October 15, 2008.
493. Governor Ritter & STEM Network, Denver, CO, October 24, 2008.
494. UMBC Lecture "Crawling out of the RNA World," Baltimore, MD, November 11, 2008.
495. Leslie Orgel Lecture in Molecular Biology, Salk Institute, La Jolla, CA, February 5, 2009.
496. ESF Forward Look Conference, Granada, Spain, February 23, 2009.
497. Colorado Forum in DC, "From Howard Hughes to CU," Washington Fairmont Hotel, Washington, DC, March 20, 2009.
498. *TIDES* (Oligonucleotide and Peptide: Technology and Product Development), Las Vegas, NV, May 17-20, 2009.
499. Rocky Mountain Life Science Investor Conference, Denver, CO, September 17, 2009.
500. National Association of Biology Teachers Conference, Denver, CO, November 12, 2009.
501. Astrobiology Seminar, University of Colorado-Boulder, January 13, 2010.
502. CU Dean's Distinguished Seminar Series, University of Colorado-Denver, January 19, 2010.
503. Colorado State University, Frontiers in Biomedical Sciences Series, Fort Collins, CO, February 17, 2010.
504. The Postdoctoral Association of Colorado, University of Colorado-Boulder, February 18, 2010.
505. Abraham Flexner Lecture, Discovery Lecture Series, Vanderbilt University, Nashville, TN, March 4, 2010.
506. National Consortium of Specialized Secondary Schools of Math, Science and Technology (NCSSSMST), Nashville, TN, March 3, 2010.
507. Discovery Lecture Series, Vanderbilt University, Nashville, TN, March 4, 2010.
508. St. Gene Lectureship, Mt. Oxford, CO, March 15, 2010.
509. Distinguished Allman Lecturer, SMU, Dedman College, Dallas, TX, March 21, 2010.
510. Biophysics Lecture, Yale University, Yale University, New Haven, CT, April 8, 2010.
511. Open Lecture, Iowa State University, Ames, IA, April 14, 2010.
512. Public Lecture, Cold Spring Harbor Laboratories, Cold Spring Harbor Laboratories, April 26, 2010.
513. Postdoctoral Research Day Lecture, University of Colorado-Denver, May 14, 2010.
514. Nobel Symposium, Genetics in Medicine, Karolinska Institutet, Stockholm, Sweden, June 15, 2010.
515. Edschrift Symposium, Howard Hughes Medical Institute, Chevy Chase, MD, August 4, 2010.
516. Colloquium in Integrative Physiology, University of Colorado-Boulder, January 13, 2011.

517. George H. Boyd Distinguished Lecture, University of Georgia, Athens, GA, January, 18, 2011.
518. Science Lecture, Georgia Center for Continuing Education, University of Georgia, Athens, GA, January 19, 2011.
519. Keynote Lecture, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, February 4, 2011.
520. 2011 Bernard Axelrod Lectureship, Purdue University, West Lafayette, IN, March 7, 2011.
521. Department of Applied Math, Distinguished Research Lecture, University of Colorado-Boulder, March 11, 2011.
522. FIRE Symposium, University of Colorado-Boulder, March 28, 2011.
523. FIRE Symposium, University of Colorado-Boulder, March 29, 2011.
524. Richard A. Scott Lecture, Northwestern University, Chicago, IL, April 5, 2011.
525. Science Lecture, University of Illinois at Chicago, April 6, 2011.
526. Molecular Biology Program Annual Mini-Symposium, RNA: More Than a Message, University of Colorado-Denver, April 14, 2011.
527. Telomeres & Telomerase Meeting, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, May 3-7, 2011 (Speaker and Session Chair).
528. Howard Hughes Medical Institute Science Meeting, Ashburn, VA, June 5-8, 2011.
529. Nina W. Matheson Lecture, AAMC Annual Meeting, November 7, 2011.
530. 5th Int'l Symposium, Molecular Science of Fluctuations toward Biological Functions, Naro Inst. of Science & Technology, Naro, Japan January 8, 2012.
531. Nobel Prize Forum, Sojo University, Kumamoto, Japan, January 10, 2012.
532. Miramontes Arts & Sciences Spring Undergraduate Colloquium, University of Colorado Boulder, January 25, 2012.
532. Distinguished Scientists Lecture and Colloquium, Trinity University, San Antonio, Texas, January 30, 2012.
533. Keystone Symposium on Protein-RNA Interactions in Biology and Disease, Santa Fe, New Mexico, March 14, 2012.
534. Duke University "Crawling out of the RNA world: ribozymes, telomerase, and other non-coding RNAs", Durham, North Carolina, March 15, 2012.
535. University of California San Francisco, March 26, 2012.
536. Silicon Flatirons Center for Law, Technology, and Entrepreneurship, University of Colorado Boulder, "Are Patents Fences or Landmines?" April 24, 2012.
537. Boulder Economic Summit, "Productive Collisions," Boulder, Colorado, June 5, 2012.
538. HHMI Scientific Meeting, Chevy Chase, MD, September 11-13, 2012.
539. Skaggs Biomedical Research Symposium, keynote speaker, Denver Colorado, Sept 27, 2012.
540. EMBO Meeting: Telomeres and the DNA Damage Response, Special Lecture, Isle sur la Sorgue, France, October 2-6, 2012.
541. First Annual LCI Down Syndrome Symposium, Denver Colorado, October 19, 2012.
542. Scholars Retreat for University of Colorado Deming Center for Entrepreneurship, "A view of entrepreneurship from the science perspective," Boulder Colorado, October 20, 2012.