




## Richard Zare

Marguerite Blake Wilbur Professor of Natural Science and Professor, by courtesy, of  
Physics  
Chemistry

 Curriculum Vitae available Online

### CONTACT INFORMATION

#### • Administrative Contact

Sippy Baniya - Administrative Associate

**Email** sbaniy@stanford.edu

**Tel** (650) 723-4313

### Bio

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#### BIO

A pioneer in the use of lasers to study chemical reactions at the molecular level, Marguerite Blake Wilbur Professor Richard N. Zare pursues diverse theoretical and experimental interests in physical chemistry and nanoscale chemical analysis. The Zarelab has made a broad impact in analytic chemistry with development of laser-induced fluorescence to study reaction dynamics, and seminal contributions to understanding of molecular collision processes. The group continues to invent tools and measurement techniques to study phenomena from reaction in microdroplets to drug delivery.

Born in 1939 in Cleveland, Ohio, Professor Zare trained in physical and analytical chemistry at Harvard University (B.A. 1961, Ph.D. 1964). His doctoral study under Professor Dudley Herschbach explored photodissociation dynamics. After faculty positions spanning chemistry at the Massachusetts Institute of Technology, chemistry, physics and astrophysics at the University of Colorado, and chemistry at Columbia University, he joined the Stanford chemistry faculty in 1977. He has taught an introductory chemistry class every year since. As a Howard Hughes Medical Institute Professor since 2006, Professor Zare has also developed a course introducing undergraduates to hands-on interdisciplinary research, combining physics, and biology to explore how living systems use molecular interactions with light for vision, photosynthesis and more. Professor Zare served as chair of the Department of Chemistry from 2005 to 2011, and has helped to guide scientific policy as chairman of several national and international science boards. His dedication to research and teaching has been recognized in many awards, including the National Medal of Science, the Wolf Prize in Chemistry, and the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring. Among other honors, Professor Zare is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and the American Philosophical Society. He has also received 11 honorary doctorates.

Current research in the Zarelab explores wide-ranging questions in physical and analytical chemistry, from the study of elementary chemical reactions to chemical analysis of extraterrestrial materials. The major focus of these efforts is chemical analysis on the nanoscale. The team has devised tools and techniques to examine molecules in extremely tiny volumes – the volumes characteristic of what is found in heterogeneous structures in mineral samples or in the contents of cells and subcellular compartments. Group members have also made contributions to the chemical analysis of liquid samples separated using a capillary format by electrophoresis or electrochromatography. Some “firsts” include the use of cavity ring-down spectroscopy to analyze trace species in solution, development of detectors

for capillary electrophoresis based on the techniques of laser-induced fluorescence, and CCD imaging, and the use of mass spectrometric imaging of tissue samples by means of desorption electrospray ionization.

Please visit the Zarelab website to learn more: <http://web.stanford.edu/group/Zarelab/>

## ACADEMIC APPOINTMENTS

- Professor, Chemistry
- Professor (By courtesy), Physics
- Member, Bio-X
- Member, Cardiovascular Institute
- Member, Stanford Cancer Institute
- Affiliate, Stanford Woods Institute for the Environment
- Member, Wu Tsai Neurosciences Institute

## ADMINISTRATIVE APPOINTMENTS

- Chair, Department of Chemistry, Stanford University, (2006-2011)
- Howard Hughes Medical Institute Professor, Stanford University, (2006-2010)
- Professor of Physics, Stanford University, (1992- present)
- Marguerite Blake Wilbur Professor in Natural Science, Stanford University, (1987- present)
- Fellow Adjoint, Joint Institute for Laboratory Astrophysics, University of Colorado, (1985- present)
- Stanford University Fellow, Stanford University, (1984-1986)
- Christensen Fellow, St. Catherine's College, Oxford University, (1982-1982)
- Shell Distinguished Professor of Chemistry, Stanford University, (1980-1985)
- Professor, Department of Chemistry, Stanford University, (1977- present)
- Higgins Professor of Natural Science, Columbia University, (1975-1977)
- Professor, Department of Chemistry, Columbia University, (1969-1977)
- Associate Professor, Department of Physics and Astrophysics and Department of Chemistry, University of Colorado, (1968-1969)
- Assistant Professor, Department of Physics and Astrophysics, University of Colorado, (1966-1968)
- Assistant Professor, Department of Chemistry, Massachusetts Institute of Technology, (1965-1966)
- Postdoctoral Research Associate, Joint Institute for Laboratory Astrophysics (JILA), University of Colorado, (1964-1965)

## HONORS AND AWARDS

- National Medal of Science, National Science Foundation (1983)
- Wolf Prize in Chemistry, Wolf Foundation, Israel (2005)
- BBVA Foundation Frontiers of Knowledge Award in the Basic Sciences category, BBVA Foundation (2010)
- King Faisal International Prize in Science, King Faisal Foundation (2011)
- Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM), U.S. Office of Science and Technology Policy (2009)
- The Welch Award in Chemistry, The Welch Foundation (1999)
- National Academy of Sciences Award in Chemical Sciences, National Academy of Sciences (1991)
- American Chemical Society Award in Analytical Chemistry, American Chemical Society (1998)
- Irving Langmuir Prize, American Physical Society (1985)

- Peter Debye Award in Physical Chemistry, American Chemical Society (1991)
- George C. Pimentel Award in Chemical Education, American Chemical Society (2008)
- Priestley Medal, American Chemical Society (2010)
- Honorary Doctorate, University of South Florida (2013)
- The International Science and Technology Cooperation Award, The People's Republic of China (2012)
- The World Academy of Sciences Lecture Medal, World Academy of Arts and Sciences (2012)
- The Torbern Bergman Medal, The Swedish Chemical Society, The Analytical Division (2012)
- Honorary Membership, Japan Society for Analytical Chemistry (JSAC) (2011)
- Einstein Professorship, Chinese Academy of Sciences (2011)
- R. B. Bernstein Award in Stereodynamics, International Symposium on Stereodynamics of Chemical Reactions (2010)
- Honorary Fellow, Chinese Chemical Society (2010)
- Theodore William Richards Medal, Northeastern Section of the American Chemical Society (2010)
- F. A. Cotton Medal for Excellence in Chemical Research, Texas A&M University, Department of Chemistry, and Texas A&M Section, American Chemical Society (2009)
- H. Julian Allen Award, NASA Ames Research Center (2007)
- Dudley R. Herschbach Award, Dynamics of Molecular Collisions Meeting, Santa Fe, New Mexico (2007)
- Honorary Doctorate, Chalmers Institute of Technology (2007)
- Oesper Award, University of Cincinnati and Cincinnati Section of the American Chemical Society (2006)
- Chandler Medal, Department of Chemistry, Columbia University (2005)
- Pupin Medal "for service to the nation", Columbia University School of Engineering (2005)
- Nichols Medal, New York Section of the American Chemical Society (2005)
- James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry, Northeastern Section of the American Chemical Society (2004)
- Laurance and Naomi Carpenter Hoagland Prize for Excellence in Undergraduate Education, Stanford University (2003)
- Honorary Doctorate, Université Paul Sabatier, Toulouse, France (2003)
- Distinguished Chemist Award, American Chemical Society Sierra Nevada Section (2002)
- Honorary Doctorate, Hunan University (2002)
- Scientific Achievement Award, California Separation Science Society (CaSSS) (2000 - 2001)
- Madison Marshall Award, American Chemical Society, North Alabama (2000)
- Honorary Doctorate, D Univ, The University of York (2001)
- Honorary Doctorate, State University of West Georgia (2001)
- Faraday Medal & Lectureship, Royal Society of Chemistry (2001)
- Charles Lathrop Parsons Award, American Chemical Society (2001)
- Nobel Laureate Signature Award for Graduate Education, American Chemical Society (2000)
- Arthur L. Schawlow Prize in Laser Science, American Physical Society (2000)
- Doctor of Philosophy, honoris causa, Uppsala University (2000)
- Doctor of Science, honoris causa, Columbia University (1999)
- E. Bright Wilson Award in Spectroscopy, The American Chemical Society (1999)
- Distinguished Service Award, National Science Board (1998)
- Centennial Medal, Graduate School of Arts and Sciences, Harvard University (1998)
- G. M. Kosalopoff Award, Auburn Section, American Chemical Society (1998)

- Eastern Analytical Symposium Award for Outstanding Achievements in the Field of Analytical Chemistry, Eastern Analytical Symposium (1997)
- Allan V. Cox Medal for Faculty Excellence Fostering Undergraduate Research, Stanford University (1997)
- NASA Exceptional Scientific Achievement Award, NASA (1997)
- Phi Beta Delta (Honorary Member), Phi Beta Delta (1997)
- California Scientist of the Year, California Science Center (1997)
- The Bing Fellowship Award, Stanford University (1996)
- ACS Division of Analytical Chemistry Award in Chemical Instrumentation, ACS Division of Analytical Chemistry (1995)
- Dannie-Heineman Preis, Akademie der Wissenschaften zu Göttingen (1993)
- Doctor of Science, Honorary Degree, Eidgenössische Technische Hochschule Zürich (1993)
- The Pauling Award, Puget Sound, Oregon and Portland Sections of the American Chemical Society (1993)
- The Harvey Prize, Technion, Israel Institute of Technology (1993)
- Doctor of Science, Honorary Degree, Northwestern University (1993)
- Willard Gibbs Medal, Chicago Section, American Chemical Society (1990)
- Doctor of Science, Honorary Degree, University of Arizona (1990)
- ISCO Award for Significant Contributions to Instrumentation for Biochemical Separations, International Stem Cell Corporation (ISCO) (1990)
- Dean's Award for Excellence in Teaching, Stanford University (1987)
- Kirkwood Award Medal, Yale University, New Haven Section of the American Chemical Society (1986)
- Michelson-Morley Award, Case Institute of Technology, Case Western Reserve University (1986)
- Harrison Howe Award, Rochester Section, American Chemical Society (1985)
- Remsen Award, Maryland Section, American Chemical Society (1985)
- Evans Award, The Ohio State University (1984)
- Spectroscopy Society of Pittsburgh Award, Spectroscopy Society of Pittsburgh (1983)
- Earle K. Plyler Prize, American Physical Society (1981)
- Michael Polanyi Medal, The Royal Society of Chemistry (1979)
- Fresenius Award, Phi Lambda Upsilon Honorary Chemical Society (1974)
- Alfred P. Sloan Fellowship, Alfred P. Sloan Foundation (1967 - 1969)
- Phi Beta Kappa award, Phi Beta Kappa Society (1961)
- Honorary Professor, Nanjing University
- Honorary Professor, Xiamen University
- Honorary Professor, Tsinghua University
- Honorary Professor, Dalian Institute of Chemical Physics
- Honorary Professor, University of Science and Technology of China
- Honorary Professor, Beijing Institute of Technology
- Honorary Professor, Institute of Chemistry Chinese Academy of Sciences
- Honorary Professor, Zhejiang University
- Honorary Professor, China Central Normal University
- Honorary Professor, Hunan University
- Honorary Professor, Changchun Institute of Applied Chemistry
- Honorary Professor, Shanghai Jiao Tong University

- Phillip W. West Lecture, Louisiana State University (2014)
- Pegram Lectures, Brookhaven National Laboratory, Upton, New York (2014)
- Fred M. Weissman Lecture in Analytical Chemistry, University of South Carolina, Columbia, South Carolina (2014)
- Wilhelm Jost Memorial Lectures, Freie Universität; Gottfried Wilhelm Leibniz Universität; Georg-August-Universität, Germany (2014)
- Centenary Lecture, Indian Institute of Science (IISc), Bangalore, India (2014)
- CV Raman Lecture, Indian Association for the Cultivation of Science (IACS), Kolkata, India (2014)
- Homi Bhabha Lecture, Tata Institute for Fundamental Research (TIFR), Mumbai, India (2014)
- Heaven and Earth Distinguished Lectures, Nanjing University, China (2013)
- James S. Plant Distinguished Lecture, Hamilton College, Clinton, New York (2013)
- Plenary Lecture, Wu Chien-Shiung Science Summer Camp, Xitou, Taiwan (2013)
- New Biology Distinguished Lecture, DGIST, Daegu, South Korea (2013)
- Jackson Lecture, University of Florida, Gainesville, Florida (2013)
- Martin Lecture, University of South Florida, Tampa, Florida (2013)
- Svedberg Lecture, Uppsala University, Uppsala, Sweden (2013)
- Linnett Visiting Professor Lectureship, Department of Chemistry, University of Cambridge, Cambridge, UK (2013)
- Lady Margaret Lecture, Christ's College, University of Cambridge, Cambridge, UK (2013)
- Department of Chemical Engineering, Tsinghua University, Beijing, China (2013)
- Department of Chemistry, Beijing Institute of Technology, Beijing, China (2013)
- Shipley Lecture, Department of Chemistry, Clarkson University (2013)
- Teickmann Lecture, SUNY Buffalo (2013)
- Bangalore Science Forum, Bangalore, India (2014)
- Visva-Bhrati University, Santiniketan, India (2014)
- King Abdullah University of Science and Technology (KAUST), Saudi Arabia (2014)
- ISIC Seminar, Ecole Polytechnique Fédérale de Lausanne, Switzerland (2012)
- Jean Dreyfus Boissevain Lecture., Bucknell University, Lewisburg, PA (2012)
- Izatt-Christensen Lecturer, Brigham Young University (2012)
- Plenary Lecture, Celebration of Chemistry, IITK, Indian Institute of Technology Kanpur (2011)
- Plenary Lecture, The Third Asian Spectroscopy Conference, Science and Art Center, Xiamen University (2011)
- Wynne-Jones Memorial Lecture, University of Newcastle (2011)
- Plenary Lecture, IUPAC International Congress on Chemical Sciences, Kyoto, Japan (2011)
- Salomon Bochner Lecture, Scientia., Rice University (2011)
- The Thirtieth Annual Barnett Lectureship, Northeastern, The Barnett Institute of Chemical and Biological Analysis (2011)
- Distinguished Lecture Series in Mathematical and Physical Sciences, National Science Foundation (2011)
- 22nd Annual Frontiers in Chemistry Symposium, The Scripps Research Institute (2011)
- Plenary Lecture, Year of Chemistry, Uppsala University (2011)
- Wolf Prize Foundation Laureate Lecture, International Symposium "Frontiers in Photon Science", University of Manchester (2010)
- Plenary Lecture, 45° Congreso Mexicano de Química y 29° Congreso Nacional de Educación, Química, Riviera Maya, Quintana Roo, Mexico (2010)
- Vail Lectures, Wake Forest University (2010)
- Plenary Lecture, International Conference on Chemical Education, Taipei, Taiwan (2010)

- Global Vision Lecture, Tsinghua University, Beijing, China (2010)
- Plenary Lecture, Chemistry Division,, Chinese Academy of Sciences, Beijing, China (2010)
- Plenary Lecture, 4th International Symposium on Bioanalysis, Changsha, China (2010)
- C. R. Mueller Memorial Lecture,, Purdue University (2010)
- Plenary Lecture, Academia Sinica, Taipei, Taiwan (2010)
- Plenary Lecture, Isranalytica, Tel Aviv, Israel (2010)
- MTSU Distinguished Lecture, Middle Tennessee State University (2009)
- NanQiang Lecture, Xiamen University, Xiamen, China (2009)
- Rajiv Gandhi Science and Technology Lecture, Bangalore, India (2009)
- Dr. Emily Davis and Dr. Homer C. Weed Lecture, Department of Chemistry and Biochemistry, University of Arizona (2009)
- A. R. Gordon Distinguished Lectures Series, University of Toronto, Toronto, Canada (2009)
- Abbott Chemistry Lectures, University of North Dakota (2009)
- Phyllis Johnson Patrick Lecture,, Kansas State University (2009)
- Platinum Jubilee Lecture, Indian Academy of Sciences, Bangalore University, Bangalore, India (2009)
- Robert S. Mulliken Lecture, University of Georgia (2008)
- Leland Wilson Endowed Lecture, University of Northern Iowa (2008)
- Frank Whitmore Lecture, The Pennsylvania State University (2008)
- Helen Murray Free Endowed Lecture, University of Wooster (2008)
- Plenary Lecture, 10th National Symposium, Chemical Research Society of India, Bangalore, India (2008)
- William A. Chupka Lectureship in Physical and Theoretical Chemistry, Yale University (2007)
- The Arnold C. Ott Lectureship in Chemistry, Grand Valley State University (2007)
- 3M/Ronald A. Mitsch Lecture in Chemistry, Hamline University (2007)
- 18th Leopold Marcus Lecture, Department of Chemistry, Washington University in St. Louis (2007)
- Nobel Laureates 2007 Beijing Forum on Energy and the Environment, Beijing, China (2007)
- Plenary Lecture, Ninth Annual Beckman Scholars Symposium, Irvine, California (2007)
- Roberts Lecturer, University College, London, UK (2007)
- Distinguished Frontiers Speaker, University of Toledo (2007)
- Ritter Memorial Lectures, Miami University of Ohio (2007)
- Keynote Speaker, Honors Week Celebration, Kent State University (2007)
- Morino Lectures, University of Tokyo and Kyoto University, Japan (2007)
- Plenary Speaker, New Zealand Institute of Chemistry Conference, Rotorua, New Zealand (2006)
- Sir Neil Waters Distinguished Lectureship, Massey University, Palmerston North, New Zealand (2006)
- Michael Faraday Lecture, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India (2006)
- Mission Bay Seminar, University of California at San Francisco (2006)
- Cal Giddings Lecture, University of Utah (2006)
- Keynote Lecture, Biennial Conference on Chemical Education (BCCE), Purdue University (2006)
- Plenary Lecture, International Workshop on Bioanalytical Chemistry and Biomedical Engineering, Hunan University, Changsa, China (2010)
- Distinguished Zhang Dayu Lecture, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian, China (2006)
- Lectures in Modern Chemistry, Department of Chemistry,, University of British Columbia, Vancouver, BC, Canada (2006)

- Spring Colloquium Speaker, Department of Chemistry & Biochemistry, University of Washington (2006)
- Frontiers in Chemical Research Lecturer, Texas A & M University (2006)
- G. Wilse Robinson Lecturer, Texas Tech University (2006)
- Vessman Lecture, Chalmers University, Göteborg, Sweden (2006)
- Plenary Speaker, Photon Science Institute Launch, University of Manchester, Manchester, UK (2006)
- Purves Lecturer, McGill University, Montreal, Canada (2005)
- Plenary Speaker, Federation of Analytical Chemistry and Spectroscopy Societies (FACCS), Quebec City, Canada (2005)
- Plenary Speaker, ScotCHEM Launch, Edinburgh, Scotland (2005)
- Plenary Speaker, CONNECT 2005, 12th Royal Australian Chemical Institute (RACI) National Convention, Sydney, Australia (2005)
- PECRUM Lecturer (Perspective on Chemistry Research), University of Michigan (2005)
- Keynote Speaker, Atlanta Undergraduate Research Alliance (AURA) (2005)
- Arthur D. Little Lecturer, Massachusetts Institute of Technology (2004)
- William E. Mahoney Lecturer, University of Massachusetts Amherst (2004)
- Mitchum E. Warren, Jr. Lecturer, Department of Chemistry, Vanderbilt University (2004)
- Robert A. Jenkins Memorial Lecturer, Department of Chemistry, University of Wyoming (2004)
- Charles Herron Lecturer, Department of Chemistry and Biochemistry, Florida State University (2004)
- Noyes Lecturer, Department of Chemistry, University of Oregon (2004)
- Plenary Lecturer, Singapore International Chemistry Conference 3, Singapore (2003)
- S. Dexter Squibb Distinguished Lecturer, Department of Chemistry, University of North Carolina (2003)
- Haberman Lecturer, Department of Chemistry, Marquette University (2002)
- Samuel M. McElvain Seminar, Department of Chemistry, University of Wisconsin-Madison (2002)
- George Gamow Memorial Lecture, University of Colorado at Boulder (2002)
- L. Carroll King Memorial Lectures, Department of Chemistry, Northwestern University (2001)
- R. T. Majors Lecturer, Department of Chemistry, University of Connecticut (2001)
- Flygare Memorial Lecturer, Department of Chemistry, University of Illinois at Urbana-Champaign (2001)
- Hirschmann Lecturer, Oberlin College (2000)
- Carr Lecturer, Department of Chemistry, Coe College (2000)
- Manuel G. Menendez Memorial Lecturer, Department of Physics and Astronomy, University of Georgia (2000)
- Anderson Lecture, Department of Physics and Astronomy, Denison University (2000)
- The Timothy J. O'Leary, S. J. Distinguished Scientist Lecturer, Science Departments of Gonzaga University (2000)
- Lyle Ramsay Dawson Lecturer, Department of Chemistry, University of Kentucky (1999)
- S. C. Lind Lecture, East Tennessee Section of the American Chemical Society (1999)
- Charles M. Knight Lecturer, Department of Chemistry, The University of Akron (1999)
- The O. K. Rice Lecturer, Department of Chemistry, The University of North Carolina at Chapel Hill (1999)
- The Lloyd B. Thomas Chemistry Scholars Lecturer, Department of Chemistry, University of Missouri (1999)
- The Joe L. Franklin Memorial Lecture, Department of Chemistry, Rice University (1999)
- Harry Emmett Gunning Lecturer, Department of Chemistry, University of Alberta (1998)
- Clifford C. Hach Lecturer, Department of Chemistry, University of Wyoming (1998)
- Barre Lecturer, University of Montreal, Canada (1998)

- Kosalopoff Lecturer, Auburn University (1998)
- Centenary Lecturer, Royal Society of Chemistry (1998)
- Anson L. Clark Memorial Lecturer, University of Texas at Dallas (1998)
- Billings Distinguished Lecturer, Montana State University (1998)
- Claude Worthington Benedum Foundation Lecturer, West Virginia University (1997)
- Robert Maurer Lecture, Department of Physics, University of Arkansas (1997)
- Frank G. and Jean M. Chesley Lectureship, Carleton College (1997)
- Jacob Bigeleisen Endowed Lecture, State University of New York Stony Brook (1996)
- Gooch-Stephens Lectureship, Baylor University (1996)
- DuPont Distinguished Speaker, Indiana University (1996)
- G.B. Kistiakowsky Lecturer, Harvard University (1996)
- Alexander M. Cruickshank Lecturer, Gordon Research Conference (1996)
- Leroy Eyring Lecturer, Arizona State University (1995)
- Velmer Fassel Lecturer, Iowa State University (1995)
- Richard C. Lord Lecturer, Massachusetts Institute of Technology (1995)
- Fred J. Robbins Lecturer, Pomona College (1995)
- Moses Gomberg Lecturer, University of Michigan (1995)
- Lemieux Lecturer, University of Ottawa (1995)
- Frederic LeRoy Conover Memorial Lecturer, Vanderbilt University (1994)
- Raymond Lemieux Lecturer, University of Ottawa (1994)
- Peter Smith Lecturer, Duke University (1994)
- Paul C. Cross Lecturer, University of Washington (1993)
- Linus Pauling Distinguished Lecturer, Oregon State University (1993)
- R.B. Bernstein Memorial Lecturer, UCLA (1993)
- Nalbandov Lecturer, University of Illinois (1993)
- George C. Pimental Lecturer, UC Berkeley (1992)
- Robert S. Mulliken Lecturer, University of Chicago (1992)
- Arthur D. Little Lecturer, Northeastern University (1991)
- J. T. Donald Lecturer, McGill University (1991)
- Frederick Kaufman Lecturer, University of Pittsburgh (1991)
- Peter A. Leermakers Symposium Lecturer, Wesleyan University (1991)
- Russell Marker Lecturer in the Chemical Sciences, Pennsylvania State University (1991)
- Ernest H. Swift Lecturer, California Institute of Technology (1991)
- Amy/Mellon Lecturer, Purdue University (1990)
- Distinguished Scientists Lecturer, Trinity University (1990)
- E. K. C. Lee Lecturer, University of California at Irvine (1989)
- Geoffrey Frew Fellow, Australian Academy of Sciences (1989)
- Max T. Rogers Lecturer, Michigan State University (1989)
- Joel Broberg Lecturer in Chemistry, North Dakota State University (1989)



- Gustavson Lecturer, University of Denver (1989)
- Kennedy Lecturer, Washington University, St. Louis (1989)
- John Albert Southern Lecturer, Furman University (1989)
- Distinguished Visiting Lecturer, University of Texas at Austin (1989)
- Procter and Gamble Lecturer, University of Illinois at Champaign- Urbana (1988)
- Xerox Lecturer, Simon Fraser University (1988)
- Marvel-Monsanto Lecturer, University of Arizona (1988)
- Appleton Lecturer, Brown University (1988)
- Walter J. Chute Distinguished Lecturer, Dalhousie University (1987)
- Edgar Fahs Smith Lecturer, University of Pennsylvania (1987)
- Charles A. McDowell Lecturer in Chemical Physics, University of British Columbia (1987)
- Weizmann Memorial Lecturer, Weizmann Institute, Rehovot, Israel (1986)
- Friend E. Clark Lecturer, West Virginia University (1986)
- Fritz London Memorial Lecturer, Duke University (1986)
- Merck Distinguished Lecturer, Rutgers University (1986)
- "Frontiers of Science" Distinguished Visiting Professor, University of Florida (1986)
- Camille and Henry Dreyfus Lecturer, Dartmouth College (1985)
- Davis Lecturer, University of New Orleans (1985)
- Priestley Lecturer, Pennsylvania State University (1985)
- Coover Lecturer, Iowa State University (1985)
- Francis E. Blacet Lecturer, University of California at Los Angeles (1985)
- Plenary Lecturer, Lasers '84 (1984)
- John E. Willard Lecturer, University of Wisconsin (1984)
- Evans Lecturer, Ohio State University (1984)
- "Frontiers in Chemical Research" Distinguished Lecturer, Texas A&M University (1984)
- Distinguished Scientist Lecturer, University of Arizona (1983)
- ICPEAC Plenary Lecturer, XIII International Conference on the Physics of Electronic and Atomic Collisions, Berlin, Germany (1983)
- William Draper Harkins Lecturer, University of Chicago (1983)
- Falk-Plaut Lecturer, Columbia University (1983)
- Dreyfus Scholar in Residence, Hope College (1982)
- Venable Lecturer, University of North Carolina (1982)
- Albert W. Noyes Lecturer, University of Texas at Austin (1982)
- Jeremy Musher Memorial Lecturer, Hebrew University (1982)
- Guggenheim Lecturer, Reading University (1982)
- Hinschelwood Lecture, Oxford University (1982 )
- Research Scholar, Drew University (1981)
- University Professor, University of Arkansas (1981)
- Honor Lecturer in Chemistry, Arizona State University (1981)
- McGregor Lecturer, Colgate College (1980)

- Baker Lecturer, Cornell College (1980)
- Kolthoff Lecturer, University of Minnesota (1980)
- William Pyle Phillips Lecturer in Chemistry, Haverford College (1980)
- Frank T. Gucker Lecturer in Chemistry, Indiana University (1979)
- Peter C. Reilly Lecturer, University of Notre Dame (1979)
- Francis Clifford Phillips Lecturer, University of Pittsburgh (1979)
- Distinguished Visiting Professor, Michigan State University (1978)
- Edward U. Condon Lecturer in Chemical Physics, University of Colorado (1977)
- Distinguished University Lecturer, University of Utah (1977)
- Sherwin Williams Lecturer, University of Illinois (1977)
- Frontiers in Chemistry Lecturer, Wayne State University (1977)
- Westinghouse Invited Lecturer in Chemistry, Pittsburgh, Pennsylvania (1976)
- Arthur D. Little Visiting Professor, Massachusetts Institute of Technology (1972)
- Harold Herborg Nielsen Lecturer, Ohio State University (1975)
- FMC Lecturer, Princeton University (1976)

#### **BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS**

- Member, Board of Trustees Committee, Stanford University (2014 - present)
- Chair, COSEPUP (Committee on Science, Engineering, and Public Policy) of the three Academies (2012 - present)
- Member, Advisory Board, School of New Sciences, DGIST, Daegu, South Korea (2012 - present)
- Director of International Advisory Board, State Key Laboratory of Chemo/Biosensing and Chemometrics, Hunan University (2012 - present)
- Fellow, TWAS, Academy of Sciences for the Developing World (2009 - present)
- Fellow, American Chemical Society (2009 - present)
- Member of the Board of Directors, Camille and Henry Dreyfus Foundation (2009 - present)
- Honorary Fellow, Indian Academy of Sciences (2008 - present)
- Fellow, Association for Women in Science (2008 - present)
- Chairman, Board of Directors, Annual Reviews Inc. (1995 - present)
- Honorary Fellow, Chemical Research Society of India (CRSI) (2007 - present)
- Senior Presidential Advisor, Hunan University (2006 - present)
- President, Molecular Frontiers Foundation (2006 - 2011)
- Chair, Academic Advisory Committee, Biomedical Engineering Center, Hunan University (2006 - present)
- Member, European Academy of Sciences (2004 - present)
- Foreign Member, Swedish Royal Academy of Engineering Sciences (IVA) (2004 - present)
- Foreign Member, Chinese Academy of Sciences (CAS) (2004 - present)
- Honorary Member, The World Jewish Academy of Sciences (2004 - present)
- Honorary Fellow, Royal Society of Chemistry (2001 - present)
- Foreign Member, Royal Society (London) (1999 - present)
- Fellow, California Council on Science and Technology (1997 - present)
- Honorary Fellow, California Academy of Sciences (1991 - present)
- Fellow, Optical Society of America (1991 - present)

- Member, American Philosophical Society (1991 - present)
- Fellow, American Association for the Advancement of Science (1985 - present)
- Member, National Academy of Sciences (1976 - present)
- Member, American Academy of Arts and Sciences (1976 - present)
- Fellow, The American Physical Society (1969 - present)
- Non-Resident Fellow, Joint Institute of Laboratory Astrophysics (1969 - present)
- Member, The Chemical Society (London) (1969 - present)
- Member, Editorial Advisory Board, Angewandte Chemie (present)
- Member, Advisory Board, DGIST (2015 - present)
- Member, Executive Committee, Board of Directors, Wonderfest, Inc. (2011 - 2014)
- Chair, International Evaluation Committee, National Science Foundation of China (2010 - 2012)
- Fellow, Michelle R. Clayman Institute for Gender Research (2008 - 2008)
- Advisor, Camille and Henry Dreyfus Foundation (2007 - 2009)
- Faculty Affiliate, Michelle R. Clayman Institute for Gender Research (2006 - 2008)
- Foreign Council Member, Institute for Molecular Science (Japan) (1999 - 2001)
- Chairman, President's National Medal of Science Selection Committee (1997 - 2000)
- Council Member, National Academy of Sciences (1995 - 1998)
- Member, National Science Board (1992 - 1998)
- Chairman, National Science Board (1996 - 1998)
- Chair, Commission on Physical Sciences, Mathematics, and Applications, National Research Council (1992 - 1995)
- Vice-Chair, Board of Directors, Annual Reviews, Inc. (1992 - 1995)
- Member, Government-University-Industry Research Roundtable of the National Academy of Sciences (1989 - 1992)
- Chairman, Panel on Basic Science and Technology Centers, National Academy of Sciences (1987 - 1987)
- Member, Directed Energy Weapons study panel, American Physical Society (1985 - 1987)
- Chairman, Division of Chemical Physics (DCP) American Physical Society (1985 - 1986)
- Vice-Chairman, Division of Chemical Physics (DCP), American Physical Society (1984 - 1985)
- Member, Committee on Atomic and Molecular Science (CAMS), National Research Council (1983 - 1985)
- Editor, Chemical Physics Letters (1982 - 1985)
- Chairman, National Science Foundation Advisory Panel (Chemistry Division) (1980 - 1982)
- Member, Editorial Advisory Board, Current Science (2014 - present)
- Member, Editorial Advisory Board, Chemistry World
- Honorary Board Member, Editorial Advisory Board, Physical Chemistry and Chemical Physics (PCCP)
- Member, Editorial Advisory Board, Analytical Sciences
- Member, Editorial Advisory Board, Central European Journal of Chemistry
- Member, Editorial Advisory Board, ChemPhysChem
- Member, Editorial Advisory Board, Chemical Physics
- Member, Editorial Advisory Board, Chemical Physics Letter
- Member, Editorial Advisory Board, Molecular Physics
- Member, Editorial Advisory Board, Journal of Separation Sciences

- Member, Editorial Advisory Board, Chinese Journal of Chromatography
- Member, Editorial Advisory Board, Brainwave
- Member, Editorial Advisory Board, Chromatography
- Member, Board of Editors, The Journal of Molecular Spectroscopy
- Member, Board of Editors, Science
- Member, Board of Editors, Cambridge University Press
- Member, Board of Editors, Applied Physics
- Member, Board of Editors, Accounts of Chemical Research
- Member, Board of Editors, Analytical Chemistry
- Member, Board of Editors, Chemical & Engineering News
- Member, Board of Editors, The Journal of Chemical Physics
- Member, Board of Editors, The Journal of Physical Chemistry
- Member, Board of Editors, Optics Letters
- Member, Scientific Advisory Board, Pufendorf Institute, Lund University
- Member, International Advisory Board, State Key Laboratory of Physical Chemistry of Solid Surfaces (PCOSS)
- Member, Scientific Advisory Board, Hybrid Vigor Institute
- Member, Scientific Advisory Board, Fluidigm
- Member, Scientific Advisory Board, Eksigent, Inc.
- Member, Scientific Advisory Board, Pharmacyclics, Inc.
- Member, Scientific Advisory Board, Prolinx, Inc.
- Member, Scientific Advisory Board, Cepheid, Inc.
- Member, Scientific Advisory Board, Picarro
- Member, Scientific Advisory Board, Wonderfest
- Member, Scientific Advisory Board, Advisory Council for Chemistry at Oxford
- Member, Scientific Advisory Board, Electronic Nobel Museum/Young Scholars Program
- Member, Scientific Advisory Board, Faraday Transactions
- Member, Scientific Advisory Board, Quanta-Ray
- Member, Scientific Advisory Board, Affymax, Inc.
- Member, Scientific Advisory Board, Miller Institute
- Member, Scientific Advisory Board, IBM

## PROFESSIONAL EDUCATION

- PhD, Harvard University (NSF Predoctoral Fellow) , Chemical Physics (1964)
- Postgraduate work, University of California at Berkeley (1963)
- BA, Harvard University , Chemistry and Physics (1961)

## LINKS

- The Zarelab: <http://web.stanford.edu/group/Zarelab/>

## Research & Scholarship

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### CURRENT RESEARCH AND SCHOLARLY INTERESTS

My research group is exploring a variety of topics that range from the basic understanding of chemical reaction dynamics to the nature of the chemical contents of single cells.

Under thermal conditions nature seems to hide the details of how elementary reactions occur through a series of averages over reagent velocity, internal energy, impact parameter, and orientation. To discover the effects of these variables on reactivity, it is necessary to carry out studies of chemical reactions far from equilibrium in which the states of the reactants are more sharply restricted and can be varied in a controlled manner. My research group is attempting to meet this tough experimental challenge through a number of laser techniques that prepare reactants in specific quantum states and probe the quantum state distributions of the resulting products. It is our belief that such state-to-state information gives the deepest insight into the forces that operate in the breaking of old bonds and the making of new ones.

Space does not permit a full description of these projects, and I earnestly invite correspondence. The following examples are representative:

The simplest of all neutral bimolecular reactions is the exchange reaction  $H + H_2 \rightarrow H_2 + H$ . We are studying this system and various isotopic cousins using a tunable UV laser pulse to photodissociate HBr (DBr) and hence create fast H (D) atoms of known translational energy in the presence of H<sub>2</sub> and/or D<sub>2</sub> and using a laser multiphoton ionization time-of-flight mass spectrometer to detect the nascent molecular products in a quantum-state-specific manner by means of an imaging technique. It is expected that these product state distributions will provide a key test of the adequacy of various advanced theoretical schemes for modeling this reaction.

Analytical efforts involve the use of capillary zone electrophoresis, two-step laser desorption laser multiphoton ionization mass spectrometry, cavity ring-down spectroscopy, and Hadamard transform time-of-flight mass spectrometry. We believe these methods can revolutionize trace analysis, particularly of biomolecules in cells.

## Teaching

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### COURSES

#### 2023-24

- Chemistry in the Kitchen: CHEM 29N (Win)

#### 2022-23

- Chemistry in the Kitchen: CHEM 29N (Win)

#### 2021-22

- Chemistry in the Kitchen: CHEM 29N (Win)

#### 2020-21

- Chemistry in the Kitchen: CHEM 29N (Win)

### STANFORD ADVISEES

#### Doctoral Dissertation Reader (AC)

Paul Chong, Vishnu Shankar, Khoi Tran

#### Postdoctoral Faculty Sponsor

Yangjie Li, Yifan Meng, Xiaowei Song, Yu Xia

Doctoral Dissertation Co-Advisor (AC)

Daniel Marron

## Publications

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### PUBLICATIONS

- **Hydrocarbon Degradation by Contact with Anoxic Water Microdroplets.** *Journal of the American Chemical Society*  
Chen, X., Xia, Y., Zhang, Z., Hua, L., Jia, X., Wang, F., Zare, R. N.  
2023
- **Valence Bond Theory Allows a Generalized Description of Hydrogen Bonding.** *Journal of the American Chemical Society*  
Shaik, S., Danovich, D., Zare, R. N.  
2023
- **One-Step, Catalyst-Free Formation of Phenol from Benzoic Acid Using Water Microdroplets.** *Journal of the American Chemical Society*  
Meng, Y., Zare, R. N., Gnanamani, E.  
2023
- **Silica particles convert thiol-containing molecules to disulfides.** *Proceedings of the National Academy of Sciences of the United States of America*  
Li, Y., Kolasinski, K. W., Zare, R. N.  
2023; 120 (34): e2304735120
- **Contact between water vapor and silicate surface causes abiotic formation of reactive oxygen species in an anoxic atmosphere.** *Proceedings of the National Academy of Sciences of the United States of America*  
Xia, Y., Li, J., Zhang, Y., Yin, Y., Chen, B., Liang, Y., Jiang, G., Zare, R. N.  
2023; 120 (30): e2302014120
- **Microlensed fiber allows subcellular imaging by laser-based mass spectrometry.** *Nature protocols*  
Meng, Y., Hang, W., Zare, R. N.  
2023
- **Interface of biomolecular condensates modulates redox reactions.** *Chem*  
Dai, Y., Chamberlayne, C. F., Messina, M. S., Chang, C. J., Zare, R. N., You, L., Chilkoti, A.  
2023; 9 (6): 1594-1609
- **Distinguishing Renal Cell Carcinoma From Normal Kidney Tissue Using Mass Spectrometry Imaging Combined With Machine Learning.** *JCO precision oncology*  
Shankar, V., Vijayalakshmi, K., Nolley, R., Sonn, G. A., Kao, C. S., Zhao, H., Wen, R., Eberlin, L. S., Tibshirani, R., Zare, R. N., Brooks, J. D.  
2023; 7: e2200668
- **Chemical imaging reveals diverse functions of tricarboxylic acid metabolites in root growth and development.** *Nature communications*  
Zhang, T., Noll, S. E., Peng, J. T., Klair, A., Tripka, A., Stutzman, N., Cheng, C., Zare, R. N., Dickinson, A. J.  
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- **Making ammonia from nitrogen and water microdroplets.** *Proceedings of the National Academy of Sciences of the United States of America*  
Song, X., Basheer, C., Zare, R. N.  
2023; 120 (16): e2301206120
- **One-Step Formation of Pharmaceuticals Having a Phenylacetic Acid Core Using Water Microdroplets.** *Journal of the American Chemical Society*  
Meng, Y., Gnanamani, E., Zare, R. N.  
2023
- **All-perfluoropolymer, nonlinear stability-assisted monolithic surface combines topology-specific superwettability with ultradurability.** *Innovation (Cambridge (Mass.))*  
Li, W., Chan, C., Li, Z., Siu, S., Chen, S., Sun, H., Liu, Z., Wang, Y., Hu, C., Pugno, N. M., Zare, R. N., Wu, H., Ren, et al  
2023; 4 (2): 100389
- **Indoor pollution: avoid harmful control measures.** *Nature*  
Davidse, A., Zare, R. N.

2023; 615 (7952): 394

- **Mechanism-Guided Design of Robust Palladium Catalysts for Selective Aerobic Oxidation of Polyols.** *Journal of the American Chemical Society*  
Ramsay-Burrough, S., Marron, D. P., Armstrong, K. C., Del Castillo, T. J., Zare, R. N., Waymouth, R. M.  
2023
- **Rapid Characterization of Antibodies via Automated Flow Injection Coupled with Online Microdroplet Reactions and Native-pH Mass Spectrometry.** *Analytical chemistry*  
Gunawardena, H. P., Ai, Y., Gao, J., Zare, R. N., Chen, H.  
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- **Silicone Wristband Spray Ionization Mass Spectrometry for Combined Exposome and Metabolome Profiling** *ISRAEL JOURNAL OF CHEMISTRY*  
Mofidfar, M., Song, X., Kelly, J. T., Rubenstein, M. H., Zare, R. N.  
2023
- **Immuno-Desorption Electrospray Ionization Mass Spectrometry Imaging Identifies Functional Macromolecules by Using Microdroplet-Cleavable Mass Tags.** *Angewandte Chemie (International ed. in English)*  
Song, X., Zang, Q., Li, C., Zhou, T., Zare, R. N.  
2023
- **Catalyst-Free Decarboxylative Amination of Carboxylic Acids in Water Microdroplets.** *Journal of the American Chemical Society*  
Meng, Y., Gnanamani, E., Zare, R. N.  
2022
- **Quantum Controlled Cold Scattering Challenges Theory.** *The journal of physical chemistry letters*  
Perreault, W. E., Zhou, H., Mukherjee, N., Zare, R. N.  
2022: 10912-10917
- **Direct C(sp<sup>3</sup>)-N Bond Formation between Toluene and Amine in Water Microdroplets.** *Journal of the American Chemical Society*  
Meng, Y., Gnanamani, E., Zare, R. N.  
2022
- **Resonant cold scattering of highly vibrationally excited D<sub>2</sub> with Ne.** *The Journal of chemical physics*  
Perreault, W. E., Zhou, H., Mukherjee, N., Zare, R. N.  
2022; 157 (14): 144301
- **Simple Estimate of the Potential Drop across an Amphiprotic Liquid-Liquid Interface.** *The journal of physical chemistry. B*  
Chamberlayne, C. F., Zare, R. N.  
2022
- **Reply to Brzeski and Jordan: Potential pyridine tautomers that can form stable dipole-bound anions.** *Proceedings of the National Academy of Sciences of the United States of America*  
Zhao, L., Song, X., Gong, C., Zhang, D., Wang, R., Zare, R. N., Zhang, X.  
2022; 119 (38): e2212433119
- **Spraying Water Microdroplets Containing 1,2,3-Triazole Converts Carbon Dioxide into Formic Acid.** *Journal of the American Chemical Society*  
Song, X., Meng, Y., Zare, R. N.  
2022
- **On-demand electrochemically controlled compound release from an ultrasonically powered implant.** *RSC advances*  
Wang, M. L., Chamberlayne, C. F., Xu, H., Mofidfar, M., Baltasvias, S., Annes, J. P., Zare, R. N., Arbabian, A.  
2022; 12 (36): 23337-23345
- **On-demand electrochemically controlled compound release from an ultrasonically powered implant** *RSC ADVANCES*  
Wang, M. L., Chamberlayne, C. F., Xu, H., Mofidfar, M., Baltasvias, S., Annes, J. P., Zare, R. N., Arbabian, A.  
2022; 12 (36): 23337-23345
- **Water-solid contact electrification causes hydrogen peroxide production from hydroxyl radical recombination in sprayed microdroplets.** *Proceedings of the National Academy of Sciences of the United States of America*  
Chen, B., Xia, Y., He, R., Sang, H., Zhang, W., Li, J., Chen, L., Wang, P., Guo, S., Yin, Y., Hu, L., Song, M., Liang, et al  
2022; 119 (32): e2209056119

- **Enzyme-photo-coupled catalysis in gas-sprayed microdroplets.** *Chemical science*  
Bai, Y., Luan, P., Bai, Y., Zare, R. N., Ge, J.  
2022; 13 (28): 8341-8348
- **Laser Ablation Electrospray Ionization Achieves 5 μm Resolution Using a Microlensed Fiber.** *Analytical chemistry*  
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- **Enzyme-photo-coupled catalysis in gas-sprayed microdroplets** *CHEMICAL SCIENCE*  
Bai, Y., Luan, P., Bai, Y., Zare, R. N., Ge, J.  
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- **Capture of Hydroxyl Radicals by Hydronium Cations in Water Microdroplets.** *Angewandte Chemie (International ed. in English)*  
Xing, D., Meng, Y., Yuan, X., Jin, S., Song, X., Zare, R. N., Zhang, X.  
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- **Investigation of Tryptic Protein Digestion in Microdroplets and in Bulk Solution.** *Journal of the American Society for Mass Spectrometry*  
Ai, Y., Xu, J., Gunawardena, H. P., Zare, R. N., Chen, H.  
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- **Insights into electrochemiluminescence dynamics by synchronizing real-time electrical, luminescence, and mass spectrometric measurements.** *Chemical science*  
Zhang, X., Lu, W., Ma, C., Wang, T., Zhu, J. J., Zare, R. N., Min, Q.  
2022; 13 (21): 6244-6253
- **Coherent Preparation of Highly Vibrating and Rotating D<sub>2</sub> Molecules.** *The journal of physical chemistry letters*  
Perreault, W. E., Zhou, H., Mukherjee, N., Zare, R. N.  
2022: 4682-4687
- **Coherent Preparation of Highly Vibrating and Rotating D-2 Molecules** *JOURNAL OF PHYSICAL CHEMISTRY LETTERS*  
Perreault, W. E., Zhou, H., Mukherjee, N., Zare, R. N.  
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- **Insights into electrochemiluminescence dynamics by synchronizing real-time electrical, luminescence, and mass spectrometric measurements** *CHEMICAL SCIENCE*  
Zhang, X., Lu, W., Ma, C., Wang, T., Zhu, J., Zare, R. N., Min, Q.  
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- **Anisotropic dynamics of resonant scattering between a pair of cold aligned diatoms.** *Nature chemistry*  
Zhou, H., Perreault, W. E., Mukherjee, N., Zare, R. N.  
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- **Capturing Reactive Carbanions by Microdroplets.** *Journal of the American Chemical Society*  
Kumar, A., Mondal, S., Mofidfar, M., Zare, R. N., Banerjee, S.  
2022
- **Sprayed Water Microdroplets Are Able to Generate Hydrogen Peroxide Spontaneously.** *Journal of the American Chemical Society*  
Mehrgardi, M. A., Mofidfar, M., Zare, R. N.  
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- **Cooperative catalysis by a single-atom enzyme-metal complex.** *Nature communications*  
Li, X., Cao, Y., Luo, K., Zhang, L., Bai, Y., Xiong, J., Zare, R. N., Ge, J.  
2022; 13 (1): 2189
- **Azapodophyllotoxin Causes Lymphoma and Kidney Cancer Regression by Disrupting Tubulin and Monoglycerols.** *ACS medicinal chemistry letters*  
Gouw, A. M., Kumar, V., Resendez, A., Alvina, F. B., Liu, N. S., Margulis, K., Tong, L., Zare, R. N., Malhotra, S. V., Felsher, D. W.  
2022; 13 (4): 615-622
- **Sprayed water microdroplets containing dissolved pyridine spontaneously generate pyridyl anions.** *Proceedings of the National Academy of Sciences of the United States of America*



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2022; 119 (12): e2200991119

- **Succinate Accumulation Is Not Sufficient for Tumorigenesis in Mouse Chromaffin Cells But Dual Loss of SDHB and NF1 Yields SDHx-Like Pheochromocytomas**  
Armstrong, N., Storey, C. M., Noll, S. E., Margulis, K., Soe, M. H., Xu, H., Yeh, B., Fishbein, L., Kebebew, E., Howitt, B. E., Zare, R. N., Sage, J., Annes, et al  
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- **Potassium Trimethylsilanolate-Promoted, Anhydrous Suzuki-Miyaura Cross-Coupling Reaction Proceeds via the "Boronate Mechanism": Evidence for the Alternative Fork in the Trail.** *Journal of the American Chemical Society*  
Delaney, C. P., Marron, D. P., Shved, A. S., Zare, R. N., Waymouth, R. M., Denmark, S. E.  
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- **SDHB knockout and succinate accumulation are insufficient for tumorigenesis but dual SDHB/NF1 loss yields SDHx-like pheochromocytomas.** *Cell reports*  
Armstrong, N., Storey, C. M., Noll, S. E., Margulis, K., Soe, M. H., Xu, H., Yeh, B., Fishbein, L., Kebebew, E., Howitt, B. E., Zare, R. N., Sage, J., Annes, et al  
2022; 38 (9): 110453
- **Optimizing Coaxial Sonic Spray Geometry for Generating Water Microdroplets.** *Analytical chemistry*  
Dulay, M. T., Chamberlayne, C. F., Zare, R. N.  
2022
- **Quantitative detection of hydrogen peroxide in rain, air, exhaled breath, and biological fluids by NMR spectroscopy.** *Proceedings of the National Academy of Sciences of the United States of America*  
Kakeshpour, T., Metaferia, B., Zare, R. N., Bax, A.  
2022; 119 (8)
- **SU086, an inhibitor of HSP90, impairs glycolysis and represents a treatment strategy for advanced prostate cancer.** *Cell reports. Medicine*  
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- **Cell-Based Ambient Venturi Autosampling and Matrix-Assisted Laser Desorption Ionization Mass Spectrometric Imaging of Secretory Products.** *Analytical chemistry*  
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2022
- **Microdroplets can act as electrochemical cells.** *The Journal of chemical physics*  
Chamberlayne, C. F., Zare, R. N.  
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- **Thermal and Catalytic Decomposition of 2-Hydroxyethylhydrazine and 2-Hydroxyethylhydrazinium Nitrate Ionic Liquid.** *The journal of physical chemistry. A*  
Chambreau, S. D., Popolan-Vaida, D. M., Kostko, O., Lee, J. K., Zhou, Z., Brown, T. A., Jones, P., Shao, K., Zhang, J., Vaghjiani, G. L., Zare, R. N., Leone, S. R.  
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- **The perils of machine learning in designing new chemicals and materials** *Nature Machine Intelligence*  
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- **Peptide and protein assays using customizable bio-affinity arrays combined with ambient ionization mass spectrometry.** *Chemical science*  
Zhang, X., Wang, W., Zare, R. N., Min, Q.  
2021; 12 (32): 10810-10816
- **Effect of relative humidity on hydrogen peroxide production in water droplets.** *QRB discovery*  
Dulay, M. T., Huerta-Aguilar, C. A., Chamberlayne, C. F., Zare, R. N., Davidse, A., Vukovic, S.  
2021; 2: e8
- **Hydrogen-Deuterium Exchange Desorption Electrospray Ionization Mass Spectrometry Visualizes an Acidic Tumor Microenvironment.** *Analytical chemistry*  
Song, X., Zang, Q., Zare, R. N.

2021

- **Peptide and protein assays using customizable bio-affinity arrays combined with ambient ionization mass spectrometry** *CHEMICAL SCIENCE*  
Zhang, X., Wang, W., Zare, R. N., Min, Q.  
2021
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Stoyanova, T., Rice, M. A., Kumar, V., Tailor, D., Garcia-Marques, F., Bermudez, A., Kanchustambham, V., Shankar, V., Inde, Z., Pandrala, M., Nolley, R., Ghoochani, A., Liu, et al  
AMER ASSOC CANCER RESEARCH.2021
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Perreault, W. E., Zhou, H., Mukherjee, N., Zare, R. N.  
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2021
- **Microdroplet Ultrafast Reactions Speed Antibody Characterization.** *Analytical chemistry*  
Zhao, P., Gunawardena, H. P., Zhong, X., Zare, R. N., Chen, H.  
2021
- **Electrocatalytic redox neutral [3+2] annulation of N-cyclopropylanilines and alkenes** *CHEMICAL SCIENCE*  
Wang, Q., Wang, Q., Zhang, Y., Mohamed, Y. M., Pacheco, C., Zheng, N., Zare, R. N., Chen, H.  
2021; 12 (3): 969–75
- **Shape resonance determined from angular distribution in D2 ( $v = 2, j = 2$ ) + He # D2 ( $v = 2, j = 0$ ) + He cold scattering.** *The Journal of chemical physics*  
Zhou, H. n., Perreault, W. E., Mukherjee, N. n., Zare, R. N.  
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2021
- **Quantum mechanical double slit for molecular scattering.** *Science (New York, N.Y.)*  
Zhou, H., Perreault, W. E., Mukherjee, N., Zare, R. N.  
2021; 374 (6570): 960-964
- **Distinguishing between Isobaric Ions Using Microdroplet Hydrogen–Deuterium Exchange Mass Spectrometry** *Metabolites*  
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2021
- **In situ DESI-MSI lipidomic profiles of mucosal margin of oral squamous cell carcinoma.** *EBioMedicine*  
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- **A Wireless Implantable Potentiostat for Programmable Electrochemical Drug Delivery** *IEEE Biomedical Circuits and Systems (BIOCAS)*  
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- **Introducing Nafion for In Situ Desalting and Biofluid Profiling in Spray Mass Spectrometry.** *Frontiers in chemistry*  
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- Tucci, J., Chen, T., Margulis, K., Orgel, E., Paszkiewicz, R. L., Cohen, M. D., Oberley, M. J., Wahhab, R., Jones, A. E., Divakaruni, A. S., Hsu, C., Noll, S. E., Sheng, et al  
2021; 11: 665763
- **Accelerated Oxidation of Organic Sulfides by Microdroplet Chemistry.** *The Journal of organic chemistry*  
Li, J. n., Liu, C. n., Chen, H. n., Zare, R. N.  
2021
  - **Condensing water vapor to droplets generates hydrogen peroxide.** *Proceedings of the National Academy of Sciences of the United States of America*  
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2020
  - **Electrocatalytic redox neutral [3 + 2] annulation of N-cyclopropylanilines and alkenes.** *Chemical science*  
Wang, Q., Wang, Q., Zhang, Y., Mohamed, Y. M., Pacheco, C., Zheng, N., Zare, R. N., Chen, H.  
2020; 12 (3): 969-975
  - **Coulometry-assisted quantitation in spray ionization mass spectrometry** *JOURNAL OF MASS SPECTROMETRY*  
Song, X., Chen, H., Zare, R. N.  
2020
  - **Mechanistic Study of Isotactic Poly(propylene oxide) Synthesis using a Tethered Bimetallic Chromium Salen Catalyst** *ACS CATALYSIS*  
Lipinski, B. M., Walker, K. L., Clayman, N. E., Morris, L. S., Jugovic, T. E., Roessler, A. G., Getzler, Y. L., MacMillan, S. N., Zare, R. N., Zimmerman, P. M., Waymouth, R. M., Coates, G. W.  
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  - **Spraying Small Water Droplets Acts as a Bacteriocide.** *QRB discovery*  
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2020: e4628
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van den Berg, J. L., Neumann, K. I., Harrison, J. A., Weir, H., Hohenstein, E. G., Martinez, T. J., Zare, R. N.  
2020
  - **Oral squamous cell carcinoma diagnosed from saliva metabolic profiling.** *Proceedings of the National Academy of Sciences of the United States of America*  
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  - **Author Correction: Optimization of Molecules via Deep Reinforcement Learning.** *Scientific reports*  
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  - **Erratum: "HD ( $v = 1, j = 2, m$ ) orientation controls HD-He rotationally inelastic scattering near 1 K" [J. Chem. Phys. 150, 174301 (2019)].** *The Journal of chemical physics*  
Perreault, W. E., Mukherjee, N., Zare, R. N.  
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  - **Highly parallel and efficient single cell mRNA sequencing with paired picoliter chambers.** *Nature communications*  
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2020; 11 (1): 2118
  - **Spraying Model PAHs on a Charged TiO<sub>2</sub> Surface for High-Efficiency Degradation** *ENERGY & FUELS*  
van den Berg, J. L., Lai, Y., Wadsworth, G. A., Lamberti, W. A., Woo, H., Raman, S., Zare, R. N.

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● **Nanoparticles decorated with granulocyte-colony stimulating factor for targeting myeloid cells.** *Nanoscale*

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● **Metabolite therapy guided by liquid biopsy proteomics delays retinal neurodegeneration.** *EBioMedicine*

Wert, K. J., Velez, G. n., Kanchustambham, V. L., Shankar, V. n., Evans, L. P., Sengillo, J. D., Zare, R. N., Bassuk, A. G., Tsang, S. H., Mahajan, V. B.  
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● **CONCENTRATION GRADIENTS INSIDE MICRODROPLETS.** *Micro total analysis systems : proceedings of the ... [Mu] TAS International Conference on Miniaturized Chemical and Biochemical Analysis Systems. [Mu] TAS (Conference)*

Chamberlayne, C. F., Santiago, J., Zare, R. N.  
2020; 2020: 212-213

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## PRESENTATIONS

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