Stanford

Richard Zare

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

Chemistry

Curriculum Vitae available Online

CONTACT INFORMATION

- **Administrative Contact**

  Sarah Fields - Administrative Associate

  Email smfields@stanford.edu

Bio

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. Kosalapoff 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, Zeijiang 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 Lausaunne, Switzerland (2012)
- Jean Dreyfus Boissevain Lecture,, Bucknell University, Lewisburg, PA (2012)
- Izatt-Christensen Lecturer, Bringham 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 Uninversity (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, 45º Congreso Mexicano de Química y 29º 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 (19983)
- 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 Philips 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

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 H2 -> H2 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 H2 and/or D2 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

COURSES

2025-26

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

2024-25

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

2023-24

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

2022-23

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

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Tristan Heck, Laura Leibfried, Max Moncada Cohen, Vishnu Shankar, Jordyn Smith

Postdoctoral Faculty Sponsor

Arin Bhakat

Doctoral Dissertation Advisor (AC)

Joshua Lyu, Jinheng Xu

Publications

PUBLICATIONS

- **Single-Rain Droplet Amperometry Reveals Spontaneous and Regulated H2O2Formation on Leaf Surfaces.** *Langmuir : the ACS journal of surfaces and colloids*
  Madani, S., Zare, R. N., Hatamie, A.
  2026
- **Dual role of gas-water microbubbles as interfacial reactors and optically active scatterers for photochemical synthesis of hydrogen peroxide** *CHEMICAL ENGINEERING JOURNAL ADVANCES*
  Rezayat, M., Shadman, S., Mehrgardi, M. A., Zare, R. N.
  2026; 26
- **Computational method to analyze linear developmental gradients reveals specific metabolite enrichment patterns in stress-tolerant maize.** *Development (Cambridge, England)*
  Sama, A. M., Cahill, S. B., Luo, S., Tripka, A. L., Meng, Y., Noll, S. E., Zare, R. N., Shah, P., Dickinson, A. J.
  2026; 153 (8)
- **Bromophenol blue degradation by contact-electro-catalysis#** *JOURNAL OF ELECTROANALYTICAL CHEMISTRY*
  Li, S., Qian, H., Xu, J., Wang, Z., Zare, R. N., Wei, D.
  2026; 1007
- **Dark Reactions in Microdroplets Explain Widespread Artifacts in Metabolomic Profiling.** *ACS measurement science au*
  Song, X., Xu, J., Sun, C., Lyu, L., Kui, H., Zhang, R., Abliz, Z., Zare, R. N.
  2026; 6 (2): 311-323
- **Water Droplet Microlightning Enables Catalyst-Free Alkane Dehydrogenation under Ambient Conditions** *ACS SUSTAINABLE CHEMISTRY & ENGINEERING*
  He, Y., Xu, J., Lyu, L., Xia, Y., Zare, R. N., Meng, Y.
  2026
- **Increased acidity of nitrogen heterocyclic compounds on water microdroplets facilitates CO₂ capture** *CHINESE CHEMICAL LETTERS*
  Wang, R., Wang, S., Zhu, C., Zhang, J., Zare, R. N., Zhu, C., Zhang, X.
  2026; 37 (4)
- **Comparison of Mass Spectrometry Imaging by Desorption Electrospray Ionization (DESI) and Desorption Electro-Flow Focusing Ionization (DEFFI).** *Metabolites*
  Tian, Y., Wei, R., Meng, Y., Zare, R. N.
  2026; 16 (4)
- **Biomolecular condensates mediate C-N bond formation** *NATURE CHEMICAL BIOLOGY*
  Song, X., Ma, Y., Chen, M. W., Yu, W., Yan, X., Xu, J., Lyu, L., Hyman, A. A., Dai, Y., Zare, R. N.
  2026
- **In situ photocatalytic formation of carbon quantum dots from corn stover via interfacial hydrogen peroxide generation** *GREEN CHEMISTRY*
  Kang, X., Yang, Q., Tang, S., Chen, Z., Budhathoki, S., Paneru, R., Kim, S., Bai, Y., Li, Q., Chen, Z., Goroncy, A., Zare, R. N., Fan, et al
  2026
- **Biomolecular Condensates Power Nitrogen Cycling via Concurrent Redox Activities.** *Journal of the American Chemical Society*
  Song, X., Lyu, L., Li, C., Ma, Y., Zhou, Y., Dai, Y., Zare, R. N.
  2026

- **Foliar dewdroplet-induced redox cascades promote early flowering in Brassicaceae plants** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Zheng, Y., Chen, B., Bao, C., Xia, Y., Zeng, C., Song, M., Shi, J., Hu, L., Yin, Y., Cui, X., Auverlot, J., Reichheld, J., Jiang, et al
  2026; 123 (8): e2527021123
- **Foliar dewdroplet-induced redox cascades promote early flowering in Brassicaceae plants.** *Proceedings of the National Academy of Sciences of the United States of America*
  Zheng, Y., Chen, B., Bao, C., Xia, Y., Zeng, C., Song, M., Shi, J., Hu, L., Yin, Y., Cui, X., Auverlot, J., Reichheld, J. P., Jiang, et al
  2026; 123 (8): e2527021123
- **Highly efficient production of nitrite and nitrate from air at the gas-water interface of nanobubbles.** *Science advances*
  Bose, S., Bahadorikhalili, S., He, Y., Samouei, H., Zare, R. N.
  2026; 12 (6): eaec4225
- **Dark Reactions in Microdroplets Explain Widespread Artifacts in Metabolomic Profiling** *ACS MEASUREMENT SCIENCE AU*
  Song, X., Xu, J., Sun, C., Lyu, L., Kui, H., Zhang, R., Abliz, Z., Zare, R. N.
  2026
- **Aqueous microdroplet chemistry enables sustainable, scalable synthesis of polyaniline** *MOLECULAR PHYSICS*
  Jallow, J., Song, X., Basheer, C., Baig, U., Alaliwi, A., Bakdash, R. S., Zare, R. N.
  2026
- **Comment on "An Alternative Explanation for Ions Put Forth as Evidence for Abundant Hydroxyl Radicals Formed Due to the Intrinsic Electric Field at the Surface of Water Droplets".** *Analytical chemistry*
  Xu, J., Song, X., Lyu, L., Zhang, X., Zare, R. N.
  2025
- **Intrinsic Electric Field Triggers Phenol Oxidative Degradation at Microbubble Interfaces.** *Journal of the American Chemical Society*
  Xu, J., Song, X., Lu, Y., Lyu, L., Basheer, C., Zare, R. N.
  2025
- **Droplet-on-demand mass spectrometry reveals curvature-dependent interfacial reactivity in aqueous microdroplets.** *Proceedings of the National Academy of Sciences of the United States of America*
  Xia, Y., Gao, X., Li, J., Zare, R. N., Chen, B., Zhang, X.
  2025; 122 (50): e2519491122
- **Generation of reactive oxygen species in water droplets levitated in air.** *Chemical science*
  Xia, Y., Li, X., Chen, F., Xu, J., Gao, X., Chen, B., Zhang, X., Zare, R. N.
  2025
- **Programmable enzyme catalysis based on multiscale confinements** *NATURE SYNTHESIS*
  Cao, Y., Qiao, W., Zhang, C., Zhu, M., Wu, Q., Lou, W., Willner, I., Zare, R. N., Ge, J.
  2025
- **Oil-water interfaces drive gold precipitation via microdroplet chemistry in thermal geological systems.** *Proceedings of the National Academy of Sciences of the United States of America*
  Yuan, G., Wang, J., Cao, Y., Jin, Z., Hao, F., Liu, K., Li, Y., Schulz, H. M., Gluyas, J., Zare, R. N.
  2025; 122 (42): e2508673122
- **Ultrafast PFAS degradation using oxidant-containing microdroplets.** *Chemical communications (Cambridge, England)*
  Yang, Y., Hassan, M. T., Yaroshuk, T., Sanchez, J. P., Young, Q. A., Zare, R. N., Chen, H.
  2025
- **Unveiling ignis fatuus: Microlightning between microbubbles.** *Proceedings of the National Academy of Sciences of the United States of America*
  Xia, Y., Meng, Y., Shi, J., Zare, R. N.
  2025; 122 (41): e2521255122
- **The air-water interfacial nitrogen cycle produces irrigatable-level ammonium nitrate** *CHEMICAL SCIENCE*
  Song, X., Basheer, C., Xu, J., Zare, R. N.
  2025

- **3D-Printed Field-free Ionization Source for Mass Spectrometry.** *Analytical chemistry*
  Tian, R., Li, J., Xia, Y., Li, J., Hu, L., Zare, R. N.
  2025
- **Anion-π interaction-induced phase separation as a prebiotic pathway to oxygenation.** *Proceedings of the National Academy of Sciences of the United States of America*
  Ren, X., Song, X., Lyu, L., Chen, M. W., Zare, R. N., Dai, Y.
  2025; 122 (39): e2508804122
- **Microdroplet-Driven Synthesis of a Metal-Organic Framework Catalyst.** *Angewandte Chemie (International ed. in English)*
  Song, X., Jallow, J., Basheer, C., Bakdash, R. S., Alaliwi, A., Alzamil, A. A., Zare, R. N.
  2025: e202515006
- **Computational method for mapping mass signatures along developmental gradients reveals a novel role for a monosaccharide tetrose in maize salt-stress response.** *bioRxiv : the preprint server for biology*
  Sama, A. M., Cahill, S. B., Luo, S., Tripka, A., Meng, Y., Noll, S. E., Zare, R. N., Shah, P., Dickinson, A. J.
  2025
- **Catalyst-Free Microbubble System for Removing Nitrous Oxide from Air** *ENVIRONMENTAL SCIENCE & TECHNOLOGY LETTERS*
  Xu, J., Xia, Y., Zare, R. N.
  2025
- **Interfacial Curvature, not Simply Size, Controls Spontaneous Hydrogen Peroxide Formation in Water Microdroplets.** *Journal of the American Chemical Society*
  Lee, K., Mehrgardi, M. A., Zare, R. N.
  2025
- **Positively Charged Water Microdroplets Ionize Surrounding Gas Molecules.** *Journal of the American Society for Mass Spectrometry*
  He, Y., Meng, Y., Zare, R. N.
  2025
- **A Wireless Implantable Closed-Loop Electrochemical Drug Delivery System** *IEEE TRANSACTIONS ON BIOMEDICAL CIRCUITS AND SYSTEMS*
  Wang, M. L., Yeon, P., Mofidfar, M., Chamberlayne, C., Xu, H., Annes, J. P., Zare, R. N., Arbabian, A.
  2025; 19 (4): 777-790
- **Electric field-driven interfacial reduction of metal ions in microdroplets: gold, silver, and nickel.** *Chemical science*
  Bose, S., Zare, R. N.
  2025
- **Interfacial Electric Fields Modulate Redox Reactions in Abiological Coacervates.** *Journal of the American Chemical Society*
  Zhang, F., Tian, Y., Wei, H., Yue, T., Gao, Y., Li, X., Zare, R. N., Zhang, X., Wang, Z.
  2025
- **Selective Photochemical Conversion of Carbon Dioxide to Formic Acid at Gas-Water Interface of Microbubbles.** *Journal of the American Chemical Society*
  Bose, S., Mehrgardi, M. A., Zare, R. N.
  2025
- **Cross-Coupling between Arylboronic Acids and Terminal Alkynes in Water Microdroplets.** *Journal of the American Chemical Society*
  Bose, S., Mofidfar, M., Zare, R. N., Gnanamani, E.
  2025
- **Synthesis of benzoquinone compounds by a microdroplet-accelerated retro-Diels-Alder reaction** *CHEMICAL SCIENCE*
  Malkoti, N., Meng, Y., Zare, R. N., Gnanamani, E.
  2025
- **Peeling tape produces strong electric fields via stick-slip friction that drive chemical reactions.** *Proceedings of the National Academy of Sciences of the United States of America*
  Gao, X., Zhou, P., Yuan, X., Li, X., Li, B., Xia, Y., Meng, Y., Zare, R. N., Zheng, T., Zhang, X.

2025; 122 (26): e2510504122

- **Imprint Desorption Electrospray Ionization Mass Spectrometry Imaging (IDESI-MSI) Reveals Absorption of Triclopyr-Based Herbicide in Plants and Mouse Organs.** *Metabolites*
  Liu, H., Tian, Y., Wei, R., Meng, Y., Zare, R. N.
  2025; 15 (7)
- **Water Droplet Microlightning Sparks Alkyne Ozonolysis.** *Journal of the American Chemical Society*
  Meng, Y., Gnanamani, E., Zare, R. N.
  2025
- **Simultaneous Detection of Polar and Nonpolar Molecules by Nano-ESI MS with Plasma Ignited by an Ozone Generator Power Supply.** *Molecules (Basel, Switzerland)*
  Tian, Y., Meng, Y., Zare, R. N.
  2025; 30 (12)
- **The metabolite itaconate is a transcriptional and posttranslational modulator of plant metabolism, development, and stress response.** *Science advances*
  Zhang, T., Klair, A., Tang, Z., Tripka, A., Luo, S., Reyes, A. V., Lee, J., Gundran, K., Noll, S. E., Wang, X., Zare, R. N., Xu, S. L., Garay-Arroyo, et al
  2025; 11 (23): eadt7463
- **Nondestructive Metabolic Monitoring of Living Organisms by Water-Droplet Extraction and Contact-Free Electrospray Ionization Mass Spectrometry.** *Analytical chemistry*
  He, Y., Chen, X., Lyu, L., Zare, R. N., Huang, G.
  2025
- **Catalyst-Free Production of Urea from Nitrate and Carbon Dioxide in Water Microdroplets.** *Environmental science & technology*
  Bose, S., Xu, J., Lee, K., Zare, R. N.
  2025
- **Clarifying the Identity of the m/z 36 Ion in Water Microdroplet Mass Spectra.** *The journal of physical chemistry. A*
  Song, X., Lyu, L., Xu, J., Xing, D., Zhang, X., Zare, R. N.
  2025
- **Microdroplet Cascade Catalysis for Highly Selective Production of Propylene Glycol under Ambient Conditions.** *Journal of the American Chemical Society*
  Dong, J., Xu, J., Meng, Z. D., Nan, Z. A., Li, W., Zare, R. N., Tian, Z. Q., Fan, F. R.
  2025
- **Challenges in Detecting Hydroxyl Radicals Generated in Water Droplets with Mass Spectrometry.** *Analytical chemistry*
  Xing, D., Gao, X., Chen, H., Zhang, J., Edwards, M. E., Liang, C., Zhu, C., Meng, Y., Zare, R. N., Xia, Y., Zhang, X.
  2025
- **Charged Water Microdroplets Enable Dissociation of Surrounding Dioxygen.** *Journal of the American Chemical Society*
  Zhou, J., Wang, Q., Cheng, G., Shen, W., Zare, R. N., Sun, X.
  2025
- **Continuous Flow Contact Electrocatalysis for Hydrogen Peroxide Production** *JOURNAL OF PHYSICAL CHEMISTRY C*
  Lee, K., Bose, S., Song, X., Choi, S. Q., Zare, R. N.
  2025
- **Spraying of water microdroplets forms luminescence and causes chemical reactions in surrounding gas.** *Science advances*
  Meng, Y., Xia, Y., Xu, J., Zare, R. N.
  2025; 11 (11): eadt8979
- **Aging-dependent evolving electrochemical potentials of biomolecular condensates regulate their physicochemical activities.** *Nature chemistry*
  Yu, W., Guo, X., Xia, Y., Ma, Y., Tong, Z., Yang, L., Song, X., Zare, R. N., Hong, G., Dai, Y.
  2025
- **Transition-State-Dependent Spontaneous Generation of Reactive Oxygen Species by Aβ Assemblies Encodes a Self-Regulated Positive Feedback Loop for Aggregate Formation.** *Journal of the American Chemical Society*

Chen, M. W., Ren, X., Song, X., Qian, N., Ma, Y., Yu, W., Yang, L., Min, W., Zare, R. N., Dai, Y.
2025

- **Blue benzoquinone from scorpion venom shows bactericidal activity against drug-resistant strains of the priority pathogen Acinetobacter baumannii.** *The Journal of antibiotics*
  Gallegos-Monterrosa, R., Cid-Uribe, J. I., Delgado-Prudencio, G., Pérez-Morales, D., Banda, M. M., Téllez-Galván, A., Carcamo-Noriega, E. N., Garza-Ramos, U., Zare, R. N., Possani, L. D., Bustamante, V. H.
  2025
- **Methane Bubbled Through Seawater Can be Converted to Methanol With High Efficiency.** *Advanced science (Weinheim, Baden-Wurttemberg, Germany)*
  Song, X., Basheer, C., Xu, J., Adam, M. M., Zare, R. N.
  2025: e2412246
- **Onsite ammonia synthesis from water vapor and nitrogen in the air.** *Science advances*
  Song, X., Basheer, C., Xu, J., Zare, R. N.
  2024; 10 (50): eads4443
- **Wet-dry cycles cause nucleic acid monomers to polymerize into long chains.** *Proceedings of the National Academy of Sciences of the United States of America*
  Song, X., Simonis, P., Deamer, D., Zare, R. N.
  2024; 121 (49): e2412784121
- **Handheld portable device for delivering capped silver nanoparticles for antimicrobial applications.** *QRB discovery*
  Naveen, K., Bose, S., Basheer, C., Zare, R. N., Gnanamani, E.
  2024; 5: e9
- **Understanding the formation of nitrate from nitrogen at the interface of gas-water microbubbles.** *Chemical science*
  Bose, S., Xia, Y., Zare, R. N.
  2024
- **Sustained Regeneration of Hydrogen Peroxide at the Water-Gas Interface of Electrogenerated Microbubbles on an Electrode Surface.** *Journal of the American Chemical Society*
  Nami-Ana, S. F., Mehrgardi, M. A., Mofidfar, M., Zare, R. N.
  2024
- **Microdroplet-Mediated Multiphase Cycling in a Cloud of Water Drives Chemoselective Electrolysis.** *Journal of the American Chemical Society*
  Chen, X., Xia, Y., Yang, Y., Xu, Y., Jia, X., N Zare, R., Wang, F.
  2024
- **Methane C(sp3)-H bond activation by water microbubbles.** *Chemical science*
  Li, J., Xu, J., Song, Q., Zhang, X., Xia, Y., Zare, R. N.
  2024
- **Unlocking the electrochemical functions of biomolecular condensates.** *Nature chemical biology*
  Dai, Y., Wang, Z., Zare, R. N.
  2024
- **Direct Conversion of N2 and Air to Nitric Acid in Gas-Water Microbubbles.** *Journal of the American Chemical Society*
  Bose, S., Mofidfar, M., Zare, R. N.
  2024
- **John I. Brauman (1937-2024).** *Science (New York, N.Y.)*
  Zare, R. N.
  2024; 385 (6715): 1280
- **A developmental gradient reveals biosynthetic pathways to eukaryotic toxins in monocot geophytes.** *Cell*
  Mehta, N., Meng, Y., Zare, R., Kamenetsky-Goldstein, R., Sattely, E.
  2024

- **Fragment Correlation Mass Spectrometry Enables Direct Characterization of Disulfide Bond Cleavage Pathways of Therapeutic Peptides.** *Analytical chemistry*
  Li, Y., Cavet, G., Zare, R. N., Driver, T.
  2024
- **As air relative humidity increases, infectivity of SARS-CoV-2 decreases within water droplets.** *QRB discovery*
  Liu, Y., Cao, L., Xia, Y., Pan, P., Rao, L., Chen, B., Zare, R. N.
  2024; 5: e6
- **Oxidation of Ammonia in Water Microdroplets Produces Nitrate and Molecular Hydrogen.** *Environmental science & technology*
  Song, X., Basheer, C., Xia, Y., Zare, R. N.
  2024
- **Catalyst-Free Transformation of Carbon Dioxide to Small Organic Compounds in Water Microdroplets Nebulized by Different Gases.** *Advanced science (Weinheim, Baden-Wurttemberg, Germany)*
  Mehrgardi, M. A., Mofidfar, M., Li, J., Chamberlayne, C. F., Lynch, S. R., Zare, R. N.
  2024: e2406785
- **Fragment correlation mass spectrometry: Determining the structures of biopolymers in a complex mixture without isolating individual components.** *Proceedings of the National Academy of Sciences of the United States of America*
  Li, Y., Cavet, G., Zare, R. N., Driver, T.
  2024; 121 (32): e2409676121
- **Biomolecular condensates can function as inherent catalysts.** *bioRxiv : the preprint server for biology*
  Guo, X., Farag, M., Qian, N., Yu, X., Ni, A., Ma, Y., Yu, W., King, M. R., Liu, V., Lee, J., Zare, R. N., Min, W., Pappu, et al
  2024
- **Visualization of the Charging of Water Droplets Sprayed into Air.** *The journal of physical chemistry. A*
  Xia, Y., Xu, J., Li, J., Chen, B., Dai, Y., Zare, R. N.
  2024
- **Water Microdroplets Surrounded by Alcohol Vapor Cause Spontaneous Oxidation of Alcohols to Organic Peroxides.** *Journal of the American Chemical Society*
  Mofidfar, M., Mehrgardi, M. A., Zare, R. N.
  2024
- **Sprayed Oil-Water Microdroplets as a Hydrogen Source.** *Journal of the American Chemical Society*
  Chen, X., Xia, Y., Wu, Y., Xu, Y., Jia, X., Zare, R. N., Wang, F.
  2024
- **Dependence on relative humidity in the formation of reactive oxygen species in water droplets.** *Proceedings of the National Academy of Sciences of the United States of America*
  Mofidfar, M., Mehrgardi, M. A., Xia, Y., Zare, R. N.
  2024; 121 (12): e2315940121
- **Molecular Mechanism for Converting Carbon Dioxide Surrounding Water Microdroplets Containing 1,2,3-Triazole to Formic Acid.** *Journal of the American Chemical Society*
  Gong, K., Meng, Y., Zare, R. N., Xie, J.
  2024
- **Evaluation of Oil-Absorbing Film for Imprint Desorption Electrospray Ionization Mass Spectrometry Imaging (IDESI-MSI) on Biological Samples.** *Metabolites*
  Li, J., Wei, R., Meng, Y., Zare, R. N.
  2024; 14 (3)
- **The power of microdroplet photochemistry.** *Chemical science*
  Song, X., Zare, R. N.
  2024; 15 (10): 3670-3672
- **The power of microdroplet photochemistry** *CHEMICAL SCIENCE*
  Song, X., Zare, R. N.

2024

- **Continuous ammonia synthesis from water and nitrogen via contact electrification.** *Proceedings of the National Academy of Sciences of the United States of America*
  Li, J., Xia, Y., Song, X., Chen, B., Zare, R. N.
  2024; 121 (4): e2318408121
- **Noninvasive Detection of Skin Cancer by Imprint Desorption Electrospray Ionization Mass Spectrometry Imaging.** *Analytical chemistry*
  Meng, Y., Chiou, A. S., Aasi, S. Z., See, N. A., Song, X., Zare, R. N.
  2023
- **Superfast Formation of C(sp2)-N, C(sp2)-P, and C(sp2)-S Vinylic Bonds in Water Microdroplets.** *Angewandte Chemie (International ed. in English)*
  Meng, Y., Zare, R. N., Gnanamani, E.
  2023: e202316131
- **Water Microdroplets-Initiated Methane Oxidation.** *Journal of the American Chemical Society*
  Song, X., Basheer, C., Zare, R. N.
  2023
- **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.
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- **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
- **A developmental gradient reveals biosynthetic pathways to eukaryotic toxins in monocot geophytes.** *bioRxiv : the preprint server for biology*
  Mehta, N., Meng, Y., Zare, R., Kamenetsky-Goldstein, R., Sattely, E.
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- **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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PRESENTATIONS

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