

Gerard Charles Dismukes

Distinguished Professor, Rutgers University

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EDUCATION

Lowell Technological Institute, Lowell, MA	Chemistry, High Honors,	BS
Univ. of Wisconsin, Madison, WI	Radiation Phys. Chemistry, Mentor: John Willard	PhD
Univ. of California & Berkeley Nat. Lab Lab Chem Biodynamics (Calvin Lab)	Biophysical Chemistry Mentors: Kenneth Sauer & Melvin Klein	postdoc

POSITIONS AND EXPERIENCE

- Visiting Professor University of Colorado, Boulder CO; Chem & Biol Eng. 2019
- Visiting scientist National Renewable Energy Laboratory, Golden, CO; 2019
- Executive Committee, Rutgers Institute of Advanced Materials & Device Nanotechnology 2013-
- Executive Committee, The Rutgers Energy Institute 2009-
- Distinguished Professor, Rutgers University 2009-
- Department of Chemistry & Chemical Biology, faculty laboratory director 2009-
- Waksman Institute of Microbiology, faculty laboratory director 2009-
- School of Environmental and Biological Sciences, graduate training program 2009-
- Senior Chemist by appointment, Princeton University 2009-
- Full, & Associate Professor: Dept. of Chemistry, Princeton University 1991, 1984
- Visiting Professor Zhejiang University, Hangzhou, China 2008
- Member the Princeton Materials Institute 1990
- Member the Princeton Environmental Institute 1995
- Visiting Professor Université Joseph Fourier, Grenoble France, 1997
- Visiting Professor Kansai-Gaikun University, Nishinomiya, Japan 1997
- Visiting Research Scientist: Squibb Institute for Medical Research, Princeton 1991
- Visiting Scientist Service de Biophysique, Dept. de Biologie, CEN-Saclay 1984

HONORS:

- DuPont Young Faculty Award
- G. D. Searle Scholars Award
- Monbusho Visiting Lectureship (Japan's Ministry of Education) RIKEN, 1983
- Alfred P. Sloane Award
- Visiting Research Fellowship, Service de Biophysique Departement de Biologie, CEN-Saclay
- Monbusho Visiting Lectureship (Japan's Ministry of Education) NIBB, Okazaki, 1987
- Squibb Institute Fellowship, Visiting Research Scientist, 1991
- Japan Society for the Promotion of Science Distinguished Visiting Fellowship Kyoto University, 1992
- National Research Council Fellowship, 1992
- CNRS Distinguished Visiting Fellow Universite Joseph Fourier, Grenoble France, 1997
- NRSA Fogarty International Fellow, 1997
- Japan Society for the Promotion of Science Distinguished Visiting Fellow Kansai-Gaikun Univ., 1997
- Lemberg Award, Australian Academy of Sciences, 2004
- Chinese Bioenergy Association Award, Chinese Academy of Science, 2008
- Excellence in Catalysis Award, Catalysis Society of Metropolitan New York, 2010
- ConocoPhillips Energy Prize Finalist, 2011

- AAAS Fellow, American Association for the Advancement of Science, 2017
- BASF Catalysis Division, special recognition, Iselin, New Jersey, 2017
- Grossman Innovation Prize, Rutgers, 2019
- **NASA CO₂ Challenge Prize co-winner phase 1, 2019**

RESEARCH Dismukes joined Rutgers University in September 2009 in two research and teaching units, one in the area of catalysis is hosted by the Dept of Chemistry & Chemical Biology located in the Wright Laboratory, another in the area of bioenergy & biocatalysis is hosted by the Waksman Institute of Microbiology.

Disciplines: Catalysis (heterogeneous, homogeneous, enzymatic) for energy storage and conversion; Materials Chemistry (inorganic and solid-state chemistry); Bioinorganic Chemistry; Chemical & biological engineering approaches to convert/store solar, electrical and chemical energy. Photosynthetic Metabolism (experimental metabolomics).

RESEARCH PROFILE

About >250 peer reviewed publications and a comparable number of national conference presentations and proceedings.

[Google Scholar Profile](#): [Citations](#)15867 (all), 5722 (since 2014); [h-index](#): 66; since 2014: 36.

[Current Research Group](#). The Dismukes group was comprised of 46 researchers in the period from 2017 to Dec 2018. 15 publications and one patent were produced during this period.

Selected Research Highlights

- 2019 Ni₃P electrocatalyst for H₂ production stable in acid.
- 2019 Highest autofermentative H₂ production yield on record Breaking the Thauer.
- 2018 NiP₂ electrocatalyst for CO₂RR, highest efficiency & selectivity to C₃ and C₄.
- 2018 Ni₃P electrocatalyst for HER that is stable in acid and base.
- 2017 TiN conducting passivation layer for photocathode-catalyst interfaces.
- 2017 Method for thin film synthesis of electrocatalyst on photoabsorber avoiding diffusion.
- 2017 Electrocatalyst and process for high efficiency CO₂ reduction to C₃ and C₄ products.
- 2017 Electrocatalyst and process for conversion of gaseous CO₂ to a solid polymer.
- 2016, 2012 Best in class noble metal free water oxidation electrocatalysts: cubic-LiCoO₂ and spinel-LiCo₂O₄ that exceed the performance of commercial ruthenium and iridium catalysts.
- 2015 Nickel phosphide (Ni₅P₄) electrocatalyst that has comparable electrical efficiency to industry standard platinum and is stable in acid and base.
- 2016, 2011 First Co₄O₄-organometallic cubane catalysts for water oxidation; complete mechanistic elucidation.
- 2009, Sustained catalytic water oxidation by a Mn₄O₄- organometallic cubane catalysts: Photocatalyst and PEC device demonstration.
- 2000 First Mn₄O₄- organometallic cubane catalysts and demonstration of water oxidation; Photocatalyst and PEC device demonstration.
- 1998- Deciphering the Mn oxidation states and mechanism of photosynthetic water oxidation.
- 1994-1998 Electronic structure of manganese-enzymes: Arginase, catalase and water oxidase
- 1994- Photoassembly of photosynthetic water oxidases and inorganic mutants.
- 1981- Discovery of the Mn₄ active site that powers oxygenic photosynthesis.

Classroom Teaching

Teaching Philosophy: “The foremost position that I hold at Rutgers is that of instructor and mentor. I personally believe in the power of inspired teaching to motivate individuals to find purpose and fulfillment from within their own creative minds. I am committed to training the next generation of scientists and citizens to use quantitative reasoning to solve problems and make good decisions.”

Two-half courses per AY (see course list below), plus assorted guest lectures. Courses feature rigorous problem solving at both pre- and post-graduate levels, including both oral and written defense of a research proposal.

- SAS, Advanced Inorganic Chemistry: (471/571 mixed graduate & undergraduate) annually since 2013
- SAS, Inorganic Chemistry: (371, undergraduate) spring 2015
- SEBS, Microbial Biochemistry (502, graduate) annually since 2010
- SAS, Harnessing Solar Energy (421, undergraduate) multiple lectures, 2011-2014
- SAS, Integrated Energy Challenges and Opportunities: NSF IGERT Training Program

Selected Courses Developed at Princeton University (1980-2009):

- Production of Renewable Fuels & Energy ENV/CHM 525 (created)
- **Astrobiology: Life in the Universe** GEO/AST/CHM/EEB 255 (co-created with Laura F. Landweber, Tullis C. Onstott, Edwin L. Turner)

Selected Presentations and Activities since 2016

2019 American Geophysical Union National Meeting, San Francisco, CA, Dec 9-13

- 2019 Bactoberfest Lecture, Rutgers Dept of Biochemistry and Microbiology, Oct 31.
- 2019 DOE BES Photosynthetic Systems PI, Gaithersburg, MD, Oct 21-23
- 2019 Gordon Research Conference, Photosynthesis, July 22-26
- 2019 Nat. Renew Energy Lab., Golden CO, Bioenergy subgroup, April, host Jian Ping Yu
- 2019 Colorado School of Mines, Golden, CO, April, host M. Posewitz
- 2019 Arizona State University, Biodesign Institute, Tempe, AZ, April 24,
- 2019 Materials Research Society, Phoenix, AZ April 22-23
- 2019 Univ. Colorado Boulder, March, host C. Musgrave
- 2019 Rutgers Laboratory for Surface Modification, April 9: 6 posters.
- 2019 Catalysis Society of Metropolitan New York, March 22: 6 posters.

2018 American Geophysical Union National Meeting, Washington, DC Dec 10-14.

- 2018 233th Electrochemical Society Meeting. presentation in the division of Electrocatalysis, Seattle, WA, May.
- 2018 International Society for Photosynthesis Research: Microbial Photosynthesis, August 9-12, Vancouver, CN, <http://isprvancouver.com/#>
- 2018 Eastern Regional Photosynthesis Meeting, Marine Biological Lab, Woods Hole, MA, May 5-6
- 2018 American Chemical Society National Meeting, Boston, MA, August 21-23.
- 2018 New York Metro Catalysis Society Symposium at Lehigh Univ, 3 posters, Easton PA, Mar 22.
- 2018 Rutgers Energy Institute, Rutgers Univ, May 1.

2017 American Geophysical Union National Meeting, New Orleans, LA, December 11-15

2017 National Renewable Energy Lab, Golden, CO, Energy Materials Network Workshop for grantees, convenor: Eric Miller, Nov 14-15.

2017 Global Climate Energy Project, Annual Symposium, poster, Stanford University, CA, Oct 17-18.

2017 232th Electrochemical Society Meeting. presentation in the division of Electrocatalysis, National Harbor, MD, Oct. 1.

2017 TIFR Colloquium, Tata Institute for Fundamental Research, Mumbai, India, convenor: Jyotishman Dasgupta, Jan 4.

2017 keynote speaker, SABIC-Society of Asian Bioinorganic Chemistry, Calcutta, India, convenors: A Dey and S. Mazumdar, Jan 6-11.

2017 New York Metro Catalysis Society Symposium at ExxonMobil, 4 posters and reviewer, Clinton, NJ, Mar 22.

2017 Rutgers Energy Institute, Symposium co-organizer, May 3

2017 Microbiology at Rutgers, posters and panel, Rutgers SEBS, Feb 25.

2017 Rutgers Laboratory of Surface Modification Symposium, posters, Mar 7.

2017 Eastern Regional Photosynthesis Meeting, Marine Biological Lab, Woods Hole, MA, April

2016 keynote speaker: Global Climate Energy Project, Annual Symposium, Stanford University, CA, Nov 2-3.

2016 keynote speaker: The Bio-Economy:Technology and Policy Paths Forward, Sept 30, convenor: Gal Hochman, Rutgers University

2016 speaker Rutgers Newark, Dept of Chemistry Sept 23

2016 Keynote speaker: American Chemical Society National Meeting, Philadelphia, PA, Inorganic Symposium, convenor: Michael Zdilla, August 21.

2016 keynote and session chair, International Hydrogen Production Conf., Hanzhou, China. May 8-12.

2016 launch of the Rutgers-Zhejiang joint project for Global Climate and Energy Project and tour of the Yantai bioreactor facility. Zhejiang University, Hanzhou, China, May 13-14.

2016 229th Electrochemical Society Meeting. presentations in the divisions of Physical and Analytical Electrochemistry, Electrocatalysis, and Photoelectrochemistry, May 29 - June 3.

2016 New York Metro Catalysis Society Symposium at Rutgers, 4 posters, New Brunswick. March 23.

2016 International Photosynthesis Research Congress, Maastrickht, NL, August 7-11

2016 Microbiology at Rutgers, Symposium, posters, Rutgers SEBS, Feb 26.

2016 Rutgers Laboratory of Surface Modification Symposium, posters, April 4.

2016 Eastern Regional Photosynthesis Meeting, posters, Marine Biological Lab, Woods Hole, Apr 8.

2016 National Renewable Energy Lab, Golden, CO, convenor: Andriy Zakutayev, April 22.

2016 Rutgers Energy Institute Symposium, posters, May 4

PATENTS and TECHNOLOGY TRANSFER, patent applications

- Dismukes, G.C. and Ruettinger, W. 2004,
<https://patentimages.storage.googleapis.com/1a/c8/fb/159412d0682959/US6803474.pdf>
- Brimblecombe, R., Spiccia, L., Dismukes, G.C., Swiegers, G.F., WATER OXIDATION CATALYSTS. US Provisional Patent 30195044, filed March 27, 2007.
<https://patentimages.storage.googleapis.com/1b/de/a0/77e7c2430e7e68/US20100143811A1.pdf>
- Brimblecombe, R., Spiccia, L., Dismukes, G.C., Swiegers, G.F., "Membranes and Photoelectrochemical Devices for Carbon-Neutral Renewable Hydrogen Generation from Water", US Provisional Patent filed March 27, 2008.

- Dismukes, G.C. and Greenblatt, M. 2011, Spinel Catalysts for Water and Hydrocarbon Oxidation. USPTO 8,932,977 B2, Issued January 13, 2015.
<https://patentimages.storage.googleapis.com/7c/bc/26/e8f3f741de8411/WO2011163626A2.pdf>
- Translation of Research to Industry, Licensing Stage: Rutgers OER Spinel LiCoO₂ was licensed to NATCO Corporation, 2013-2014.
- RU Patent disclosure: Dismukes, G. C., Greenblatt, M. & Laursen, A. “Nickel phosphides electrocatalysts for hydrogen evolution reactions” US PCT filed Dec 31, 2013.
<https://patentimages.storage.googleapis.com/69/ba/79/45001aae52ef88/US20160355936A1.pdf>
- RU Patent disclosure, Dismukes, G. C., Greenblatt, M. & Laursen, A., Whitaker, M., "Nickel-3 phosphide (Ni₃P) a low phosphorous hydrogen evolution electrocatalyst" - provisional application; docket #2015-151; ref. 070439.01097. Amended title: “Nickel phosphides and nickel phosphide:iron phosphide alloys as hydrogen evolution electrocatalysts”.
- RU Patent disclosure: Dismukes, G. C., Greenblatt, M., Laursen, A., Calvinho, K. “Transition metal phosphides as a new type of catalyst for direct electrochemical CO₂ reduction to hydrocarbons” NOI filed October 7, 2015.
<https://patentimages.storage.googleapis.com/41/9b/8e/f728e329703d6e/US20180282885A1.pdf>

Entrepreneurship

2018 Cofounder and CSO RenewCO₂, a startup venture to develop Rutgers patented technology.

National & International Public Service, 2015 –present

2019 Second Annual Advanced Water Splitting Technology Pathways: Benchmarking and Protocols Workshop. October

<https://www.eiseverywhere.com/ereg/newreg.php?eventid=465805&>

2019, 2017, 2016, 2015 & 2013 DOE AMR: Hydrogen and Fuel Cell Technologies Research, Development and Demonstrations; Review panel.

2017 DOE-National Renewable Energy Lab, Golden, CO, Energy Materials Network Workshop on metrics for solar hydrogen production, convenor: Eric Miller, Nov 14-15.

2016 panel and presenter, DOE Workshop on Advanced Water Splitting Materials for hydrogen production from renewable energy sources. U.S. Department of Energy’s (DOE’s) Fuel Cell Technologies Office (FCTO), April 14-15; sponsors Lawrence Berkeley National Laboratory, and Stanford University; Palo Alto, CA.

2015 NSF Division of Chemical, Bioengineering, Environmental, and Transport Systems (CBET), Sustainability Review Panel (Microbial biofuels); Proposal review panel.

Service to the Profession

- 2019 advisory: [BASF The Chemical Company, Environmental Catalyst Division](#), Iselin, NJ; W. Ruettinger
- 2017 Rutgers Solar Panel for Solar Panels, March 21, Sponsor: NJPIRG Student Chapter.
- 2016 advisory: [BASF The Chemical Company, Environmental Catalysis Division](#), Iselin, NJ, Dr. Wolfgang Ruettinger
- 2015 advisory: Royal Swedish Academy of Sciences, invited to nominate the Noble Prize in Chemistry.
- 2014-2015 advisory: [BASF The Chemical Company, Electrochemistry Division](#), Ludwigshafen, Germany; Drs. Domnik Bayer and Marin Krauss
- 2014-2015 advisory: [BASF The Chemical Company, Analytical Services Division](#), Iselin, NJ; Dr. Prasad Subramanian.
- 2012 advisory: [BASF The Chemical Company, Environmental Catalyst Division](#), Iselin, NJ; Drs. Gerald Koerner and Xiaofan Yang.

- 2011-2013 Advisory: [NATCO Corporation](#); Director of Research: Dr N. Rao.
- 2013-2008 Member of the International Advisory Committee of the State Key Laboratory of Clean Energy Utilization , Zhejiang University, Hangzhou, China; Director: Zhongyang Luo & Kefa Cen;
- National Program reviewer for: DOE-BES, DOE-NREL, AFOSR, NSF-GETF, NSF-Inorganic Chemistry Div., NSF-Metabolic Biochemistry; Canadian National Science & Engineering Research Council, AGENO; NIH Metallobiochemistry Resource Center Study Group for National EPR Facilities; NIH Molecular Biophysics Training Grant Study Group; NIH-Chem&Bioanalytical Science Rev. Panel; NIH-Postdoctoral Award Review Panel
- Founding Member Soc. Biological Inorganic Chem. & Editorial Board, J.Biological Inorganic Chemistry
- American Chemical Society: member, nat. meeting symposium organizer, past President Princeton Chapter
- Consultantships: 2019 DeNora; 2011-2014 BASF; 2011 NATCO; 2009 New Energy Venture Partners, 2008: V.P. Engineering Analysis, Directed Technologies, Inc., 2008: Venrock VC, 2008: Ergo Advisors; 2008: National Renewable Energy Laboratory; 2007: GCEP-Stanford University; 2004: Bingham McCutchen; 2001: Sarnoff Laboratories; 2001: Agere Systems; 2001: Allied Innovative Systems; 2000: NJ Dept Environmental Protection; 1999: Sakana Inc.

Rutgers Service Committees

- SAS adhoc Advisory Committee Appointments & Promotions, 2019-2020
- IAMDN Executive Committee, 2013-2017
- REI Executive Committee, 2009-ongoing
- CCB External Awards Committee, Chair
- CCB Inorganic Division
- CCB Graduate Admissions Committee
- CCB Graduate Recruiting Committee
- Waksman Institute Directors Committee
- Waksman Institute, External Awards Committee
- SEBS MBB Graduate Admissions
- SEBS MBB Comprehensive Exam Committee
- SAS Ad Hoc Promotions Committee, 2010
- SAS Ad Hoc Alumni Relations/Reunions, secured \$50K to launch Rutgers Tech Advance, 2012-2015
- Office of Technology Commercialization, advisor to launching of *TechAdvance*, Rutgers Alumni donations