**Gerard Charles Dismukes**
Distinguished Professor, Rutgers University
dismukes@rutgers.edu; Tel. 609-213-2210;
Department of Chemistry & Chemical Biology: http://rutchem.rutgers.edu/dismukes_charles
Waksman Institute of Microbiology: https://www.waksman.rutgers.edu/dismukes

## *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, 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
- 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 $CO_2$ 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 >17,000 (all), h-index: 68;

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 $Ni_3P$ electrocatalyst for $H_2$ production stable in acid.
- 2019 Highest autofermentative $H_2$ production yield on record. Breaking the Thauer limit.
- 2018 $NiP_2$ electrocatalyst for CO2RR, highest efficiency & selectivity to C3 and C4.
- 2018 $Ni_3P$ 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 $CO_2$ reduction to C3 and C4 products.
- 2017 Electrocatalyst and process for conversion of gaseous $CO_2$ to a solid polymer.
- 2016, 2012 Best in class noble metal free water oxidation electrocatalysts: cubic-$LiCoO_2$ and spinel-$LiCo_2O_4$ that exceed the performance of commercial ruthenium and iridium catalysts.
- 2015 Nickel phosphide ($Ni_5P_4$) electrocatalyst that has comparable electrical efficiency to industry standard platinum and is stable in acid and base.
- 2016, 2011 First $Co_4O_4$-organometallic cubane catalysts for water oxidation and mechanistic elucidation.
- 2009, Sustained catalytic water oxidation by a $Mn_4O_4$- organometallic cubane catalysts: Photocatalyst and PEC device demonstration.
- 2000 First $Mn_4O_4$- organometallic cubane catalysts and demonstration of water oxidation; Photocatalyst and PEC device demonstration.
- 1998- Assignment of Mn oxidation states of photosynthetic water oxidation.
- 1994-1998 Electronic structure of mangano-enzymes: Arginase, catalase and water oxidase
- 1994- Photoassembly of photosynthetic water oxidases and inorganic mutants.
- 1981- Discovery of the $Mn_4$ 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 grad & undergrad) 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 2017-19*

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

## *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 $LiCoO_2$ was licensed to NATCO Corporation, 2013-2014.
- RU Patent disclosure: Dismukes, G. C., Greenblatt, M. & Laursen, A. "Nickel phosphides electro-catalysts 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".
- USPTO Patent US10, 358,727: Dismukes, G. C., Greenblatt, M., Laursen, A., Calvinho, K.. Nickel Phosphide Catalysts for Direct Electrochemical CO2 Reduction to Hydrocarbons; Terminal Disclaimer Issued Apr 4, 2018. https://patentimages.storage.googleapis.com/41/9b/8e/f728e329703d6e/US20180282885A1.pdf
- U.S. NonProvisional Patent Application Serial No. 15/765,896 For: Nickel Phosphide Catalysts for Direct Electrochemical CO2 Reduction to Hydrocarbons, Filed: April 4, 2018; Rutgers Tech ID: 2016-034 / Fox Rothschild File No.: 070439.01378; Issued June 9, 2020.
- RU NOI disclosure: "Unitized device for the production of hydrocarbons and carbohydrates with chlorine or hypochlorite using transition metal phosphides. Filed: Aug 8, 2019.

## *Entrepreneurship*

2018 Cofounder and CSO Renew$CO_2$, a startup venture to develop Rutgers patented technology.

## *National & International Public Service, 2015 –2019*

- 2019, 2018, 2017 **DOE-EERE H2 & Fuel Cell Technologies RD&D**; Annual Merit Review panelist.
- 2017 **DOE-EERE HydroGEN EMN** Consortium. at NREL in Golden, Colorado. Nov 14-16.
- 2019 **DOE-EERE Benchmarking** Workshop at ASU, Tempe AZ.
- 2019 **NSF-STC, Science & Technology Centers** Panel Review, Arlington, VA
- 2019 **NSF-CBET** Sustainability Review Panel (Microbial biofuels); Proposal review panel.
- 2019, 2017: National Program reviewer for DOE-EERE, DOE-H2-FCTO.

## *Service to the Profession*

- 2020 NAM27, Organizing Committee North American Catalysis Meeting.
- 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.

## *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

## *Recent Publications*

Google Scholar Publications: https://scholar.google.com/citations?user=0w3cRS0AAAAJ&hl=en