MICHAEL J. SAILOR PHD, FRSC, FNAI

DISTINGUISHED PROFESSOR
DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
DEPARTMENT OF BIOENGINEERING
DEPARTMENT OF NANOENGINEERING
DIRECTOR, NSF MATERIALS RESEARCH SCIENCE AND ENGINEERING CENTER (MRSEC)
DIRECTOR, UC SAN DIEGO INSTITUTE FOR MATERIALS DISCOVERY & DESIGN
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Education:

1988-90	Post-doctoral Associate, Stanford University and the California Institute of Technology. Directed by Prof. Nathan S. Lewis. Investigated semiconductor/polymer interfaces.
1983-88	Ph.D. in Inorganic Chemistry, Northwestern University, Evanston, IL, under the direction of Prof. Duward F. Shriver. Thesis: *"Characterization and Reactivity of the CCO Ligand in Trinuclear Ruthenium Carbonyl Clusters"*
1979-83	B.S. in Chemistry, Harvey Mudd College

Appointments:

2020-present	Director, NSF Materials Research Science and Engineering Center (MRSEC)
2022-present	Director, UC San Diego Institute for Materials Discovery & Design
2019-2022	Co-Director, UC San Diego Institute for Materials Discovery & Design
2019-2020	Visiting Professor, Zhejiang University, China
2017-2020	Visiting Professor, Hangzhou Normal University High Level Talent Program, Key Laboratory of Organosilicon Chemistry and Material Technology, China
2015-present	Distinguished Professor, Department of Chemistry and Biochemistry, University of California, San Diego
1996-2015	Professor, Department of Chemistry and Biochemistry, University of California, San Diego
2012	Invited Professor, Associate Researcher, CNRS Institut Charles Gerhardt, Montpellier, France
2008-present	Affiliate Professor, Department of Bioengineering, University of California, San Diego
2008-present	Affiliate Professor, Department of Nanoengineering, University of California, San Diego
2006-present	Member, Moores Cancer Center at the University of California, San Diego
1994-96	Associate Professor, Department of Chemistry and Biochemistry, University of California, San Diego
1990-94	Assistant Professor, Department of Chemistry and Biochemistry, University of California, San Diego

Service and Activities (current):

2022-present	Scientific Advisory Board, Impilo Therapeutics
2022-present	Co-founder, Precis Therapeutics
2022-present	Scientific Advisory Board, AivoCode

2021-present	Physical and Life Sciences External Review Committee, Lawrence Livermore National Laboratory
2020-present	Executive Advisory Board, *Advanced Materials*
2017-present	Editorial Advisory Board, *Applied Physics Letters*
2013-present	External Advisory Committee, Doris A. Howell Foundation
2011-present	Scientific Advisory Board, TruTags, inc.
2011-present	Editorial Advisory Board, *ACS Nano*
2010-present	Founder and Member of the Board of Directors, Spinnaker Biosciences, inc.
2010-present	CT2 Moores Cancer Center External Advisory Committee
2006-present	Conference Co-Chair, Porous Semiconductors Science and Technology (PSST) international conference.
2004-present	Executive Committee of the Sensor Division, The Electrochemical Society, inc.
1994-present	Executive Committee, Materials Science & Engineering Ph.D. program, the University of California, San Diego
1998-present	International Advisory Board, Porous Semiconductors Science and Technology (PSST) international conference

Service and Activities (past):

2017-2024	Associate Editor, *ACS Sensors*
2023	Expert witness, engaged by Haug Partners LLP. Case: Supernus Pharmaceuticals, inc., *vs* Apotex inc. and Apotex corp. Civil Action No. 20-7870 (FLW, TJB consolidated), District Court of New Jersey
2023	Expert witness, engaged by Haug Partners LLP. Case: Gator Bio, Inc., Petitioner, *vs* Sartorius BioAnalytical Instruments, Inc., Patent Owner; In the matter of Certain Bio-Layer Interferometers and Components Thereof; testified before the US International Trade Commission, IPR2023-00215, Washington, DC
2022-2023	Scientific Advisory Board, Lisata Therapeutics (NASDAQ: LSTA)
2015-2022	Editorial Advisory Board, *Nanoscale Horizons*
2020-2022	Board of Directors, Cend Therapeutics
2016-2022	Member, NIH Nanotechnology Study Section (NANO)
2019-2020	Founder, Impilo Therapeutics
2017-2021	Scientific Advisory Board, Matrix Industries, inc.
2015-2017	Editorial Advisory Board, *ACS Sensors*
2014	Visiting Committee, Review of the UCSB Materials Science Department
2013-2017	Associate Editor, *Molecular Cancer Therapeutics*
2012-2017	Scientific Advisory Board, Silicium Energy, inc.
2012-2022	Scientific Advisory Board, Pacific Integrated Energy, inc.
2011-2016	Editorial Advisory Board, *Advanced Healthcare Materials*
2010-2015	External Advisory Board, Program of Excellence in Nanotechnology, Mount Sinai School of Medicine
2009-2018	Scientific Advisory Board, NanoTechNexus
2008-2016	Member, San Diego Science Festival “Nifty Fifty” Science Educators Series
2007-2009	Editorial Advisory Board, *Analytical Chemistry*
2006-2013	External Advisory Committee, Michigan Nanotechnology Institute for Medicine and Biological Sciences, MNIMBS
2006-2010	Scientific Advisory Board, United States Air Force
2005-2012	Editorial Advisory Board, *JCS Chemical Communications*
2005-2009	Executive Committee, University of California Toxic Substances Research and Teaching Program
2004-2005	Scientific Advisory Board, Iatroquest, inc.
2004-2013	Scientific Advisory Board, *EarthSky*

2003-2009	Scientific Advisory Board, NanoBioNexus
2003-2007	Scientific Advisory Board, Protein Discovery, inc.
2002-2008	Editorial Advisory Board, *Nanotechnology Newsletter*
2002-2003	Scientific Advisory Board, Qgenics, inc.
2002	Organizing committee, "Challenges for the Chemical Sciences in the 21st Century: Homeland Defense and National Security." Workshop Sponsored by the National Research Council.
2001	Member, Technical Advisory Panel, Chemical and Biological Agent Resistance Test (CBART) Working Group
2000	Organizer, Army Workshop on CBW Agent Water Monitors
2000	Participant, COSEPUP focus group on Department of Defense (DOD) adherence to the Government Performance and Results Act (GPRA)
1999-2000	Review panelist, DOD Technology Area Review and Assessment (TARA) on Chemical and Biological Warfare defense
1998-2000	Scientific Advisory Board, Illumina, inc.
1997-99	Defense Sciences Study Group Member (DSSG)
1993-2020	Editorial Advisory Board, *Advanced Materials*

Awards and Honors:

2022	Leigh T. Canham Award in Porous Semiconductors Science and Technology
2019	Named "Highly Cited Researcher" Web of Science (recognition.webofsciencegroup.com/awards/highly-cited/2019/)
2019	Cecil and Ida Green Honors Professor, Texas Christian University
2019	*Advanced Materials* "Hall of Fame" researcher (www.advancedsciencenews.com/hall-of-fame-highlights-michael-j-sailor)
2018	Named "Highly Cited Researcher" Clarivate Analytics (hcr.clarivate.com)
2018	Inaugural Distinguished Lecturer, Department of Biomedical Engineering, Texas A & M University
2016	Fellow of the Royal Society of Chemistry
2015	Elected Fellow, National Academy of Inventors
2013	Chancellor's Award for Postdoctoral Scholar Mentoring, UC San Diego
2013	Outstanding Alumnus Award, Harvey Mudd College
2012	Elected Fellow, American Association for the Advancement of Science
2011	"Best of Green: Science and Technology" award from *Treehugger—A Discovery Company.*
2010	Meritorious Civilian Service Award, United States Air Force
2010	Leslie E. Orgel Scholar in Inorganic Chemistry, UCSD
2008	J. Clarence Karcher Medal, University of Oklahoma
2007	Best Scientific Advance of 2007, PETA "Proggy" Progress Award
2006	"Bronze Phantom Award" recipient from the Boeing Company, Phantom Works Division
2004	Outstanding Faculty Mentor in the Sciences and Engineering, UC San Diego Faculty Mentor Program
2004	Lipscomb Lecturer, University of South Carolina
2003	Grand Prize, National Inventors Hall of Fame Collegiate Inventors Competition (shared with graduate student Jamie R. Link)
2003	63rd Frontiers In Chemistry Distinguished Lecturer, Case Western Reserve University
2002	Max T. Rogers Distinguished Lecturer, Michigan State University
2002	"The Best of What's New" general technology award winner, Popular Science Magazine

1999	Annual Award for Architectural Research, Architecture® Magazine
1995	University of California Presidential Award for Excellence in Undergraduate Research
1994-95	Alfred P. Sloan Foundation Fellow
1994-95	Camille Dreyfus Foundation Teacher-Scholar Award
1993-98	National Science Foundation Young Investigator Award
1993-94	Arnold and Mabel Beckman Foundation Young Investigator Award
1983	ARCO Fellow, Northwestern University

Biographical Information--Michael J. Sailor, Ph.D.

Michael J. Sailor is Distinguished Professor at the University of California, San Diego, Director of the UC San Diego Materials Research Science and Engineering Center (an NSF MRSEC), and Director of the UC San Diego Institute for Materials Discovery & Design. He holds Affiliate Appointments in the UCSD Bioengineering Department, the Nanoengineering Department, and the Materials Science and Engineering program. He was trained at Harvey Mudd College (BS Chemistry), Northwestern University (PhD Chemistry), Stanford (Post-doctoral), and Caltech (Post-doctoral). Other appointments include: Invited Professor, CNRS Institut Charles Gerhardt in Montpellier, France (2012); Visiting Professor, High Level Talent Program, Key Laboratory of Organosilicon Chemistry and Material Technology, Hangzhou Normal University, China (2018-2020); and Visiting Professor, Zhejiang University, China (2019-2020). He has supervised more than 160 undergraduate, graduate, and post-doctoral students, he is the author of more than 260 peer-reviewed research publications, one book, and 39 issued patents. He has an H-Index (Google Scholar) of 100. He has founded or co-founded four companies, including Lisata Therapeutics (NASDAQ: LSTA). He is an elected Fellow of the American Association for the Advancement of Science, the U.S. National Academy of Inventors, and the Royal Society of Chemistry.

Research Interests

Professor Sailor's research focuses on silicon-based nanomaterials, with emphasis on drug delivery, imaging, and sensing applications. He is an expert in the chemistry, electrochemistry, and optical properties of nanomaterials, in particular porous silicon-based systems.

25 SELECTED LEADING PUBLICATIONS-ANNOTATED

of >250 peer-reviewed publications; h-index (Google Scholar): 100; total citations >40,000

1. Heinrich, J.L., Curtis, C.L., Credo, G.M., Kavanagh, K.L., and Sailor, M.J., "Luminescent colloidal Si suspensions from porous Si." *Science* **1992**, *255*, 66-8. *First report of micro- and nanoparticles prepared from porous Si. The ultrasound method described here remains the leading means to prepare particles of electrochemically etched porous Si. Cited 347 times.*
2. Lauerhaas, J.M., Credo, G.M., Heinrich, J.L., and Sailor, M.J., "Reversible Luminescence Quenching of Porous Si by Solvents." *J. Am. Chem. Soc.* **1992**, *114*, 1911-2. *First report of photoluminescence quenching of porous Si by molecular adsorbates. Cited 269 times.*
3. Green, W.H., Le, K.P., Grey, J., Au, T.T., and Sailor, M.J., "White Phosphors from a Silicate-Carboxylate Sol-Gel Precursor that Lack Metal Activator Ions." *Science* **1997**, *276,* 1826-8. *Reported the discovery of a non-aqueous sol-gel reaction that generates intrinsically luminescent Si oxide material. Cited 436 times.*
4. Lin, V.S.-Y., Motesharei, K., Dancil, K.S., Sailor, M.J., and Ghadiri, M.R., "A Porous Silicon-Based Optical Interferometric Biosensor." *Science* **1997**, *278*, 840-3. *First porous silicon biosensor paper. Showed the interference spectrum from a porous Si film can be used as a label-free biosensor. Cited 1854 times.*
5. Sohn, H., Létant, S., Sailor, M.J., and Trogler, W.C., "Detection of fluorophosphonate chemical warfare agents by catalytic hydrolysis with a porous silicon interferometer." *J. Am. Chem. Soc.* **2000**, *122*, 5399-400. *Showed that catalytic reactions can be coupled to the optical response from porous Si to amplify detection of chemicals. First detection of a chemical warfare agent with porous Si. Cited 390 times.*
6. Colicos, M.A., Collins, B.E., Sailor, M.J., and Goda, Y., "Remodeling of Synaptic Actin Induced by Photoconductive Stimulation" *Cell* **2001**, *107*, 605-16. *First example of photoelectrochemical stimulation of live cells using a photoconductive substrate (silicon) as a cellular host. Cited 346 times.*
7. Cunin, F., Schmedake, T.A., Link, J.R., Li, Y.Y., Koh, J., Bhatia, S.N., and Sailor, M.J., "Biomolecular screening with encoded porous silicon photonic crystals." *Nature Mater.* **2002**, *1*, 39-41. *First demonstration of the use of optical signatures etched into porous Si particles to act as encoding elements. Now referred to as "Spectral Barcodes." Technology licensed to TruTag, inc., marketed under the TruTag trademark (www.trutags.com) Technology also licensed to Minus9, inc. (www.minus9labs.com), marketed under the MINT trademark. Cited 538 times.*
8. Sohn, H.; Sailor, M. J.; Magde, D.; Trogler, W. C. "Detection of Nitroaromatic Explosives Based on Photoluminescent Polymers Containing Metalloles." *J. Am. Chem. Soc.* **2003**, *125*, 3821-3830. *Photoluminescent silicon-based polymers respond selectively to nitroaromatic molecules. Technology spawned the company RedXDefense. Cited 769 times.*
9. Li, Y.Y., Cunin, F., Link, J.R., Gao, T., Betts, R.E., Reiver, S.H., Chin, V., Bhatia, S.N., and Sailor, M.J., "Polymer Replicas of Photonic Porous Silicon For Sensing and Drug Delivery Applications." *Science* **2003**, *299*, 2045-2047. *First demonstration of the use of porous Si as a template to generate nanostructured polymers. Comprises one of the core*

technologies of Spinnaker Biosciences, inc. Cited 543 times.

10. Link, J.R. and Sailor, M.J., "Smart Dust: Self-assembling, self-orienting photonic crystals of porous Si." *Proc. Nat. Acad. Sci.* **2003**, *100*, 10607-10. *"Smart dust" paper illustrating the interplay of electrochemistry, chemistry, and optics to generate functional nanostructures. Cited 157 times.*
11. Dorvee, J. R.; Derfus, A. M.; Bhatia, S. N.; Sailor, M. J. "Manipulation of liquid droplets using amphiphilic, magnetic 1-D photonic crystal chaperones." *Nature Mater.* **2004**, *3*, 896-899. DOI: doi:10.1038/nmat1253. *First paper incorporating magnetic nanoparticles and into a porous Si photonic nanostructure. Cited 290 times.*
12. Pacholski, C., Sartor, M., Sailor, M.J., Cunin, F., and Miskelly, G.M., "Biosensing using porous silicon double-layer interferometers: reflective interferometric Fourier transform spectroscopy." *J. Am. Chem. Soc.* **2005**, *127*, 11636-45. *Introduced the RIFTS (Reflectance Interference Fourier Transform Spectroscopy) technique as a nondestructive means of characterizing porous multilayers. Cited 439 times.*
13. Park, J.-H.; Maltzahn, G. A. v.; Zhang, L.; Schwartz, M. P.; Bhatia, S. N.; Ruoslahti, E.; Sailor, M. J., "Magnetic Iron Oxide Nanoworms for Tumor Targeting and Imaging." *Adv. Mater.* **2008**, *20*, 1630-1635. *Described the first synthesis of worm-shaped iron oxide (magnetite) nanoparticles now known as "nanoworms". This comparative study showed that nanoworms display superior tumor targeting (both in vitro and in vivo) relative to more well-known spherical iron oxide nanoparticles. Selected "Best work published in Advanced Materials in 2008" by the Editors. Cited 604 times.*
14. Park, J.-H.; Gu, L.; Maltzahn, G. v.; Ruoslahti, E.; Bhatia, S. N.; Sailor, M. J., "Biodegradable luminescent porous silicon nanoparticles for in vivo applications," *Nature Mater.* **2009**, *8*, 331-336. *First in-vivo use of intrinsically luminescent Si nanoparticles. Shows that 150 nm-scale porous Si nanoparticles overcome many of the disadvantages of smaller (< 6 nm) inorganic nanocrystals (CdSe, for example). This work is important for its low in vivo toxicity and its demonstration of in vivo imaging with an intrinsically luminescent Si nanocrystal. In 2012, it was selected by the editors of Nature Materials as one of the "landmark articles" published in the journal over the past ten years. Cited 2082 times.*
15. Orosco, M. M.; Pacholski, C.; Sailor, M. J., "Real-time monitoring of enzyme activity in a mesoporous silicon double layer." *Nature Nanotech.* **2009**, *4*, 255-258. *Demonstrated immobilization of nanogram quantities of enzyme in a 5 nL volume, and showed that the optical response can be used to quantify enzyme kinetics. The importance of this work is it demonstrated a multifunctional nanostructure used to simultaneously separate and detect products of a biological reaction. Cited 232 times.*
16. Alvarez, S. D.; Li, C.-P.; Chiang, C. E.; Schuller, I. K.; Sailor, M. J., "A Label-Free Porous Alumina Interferometric Immunosensor." *ACS Nano* **2009,** *3*, 3301-3307. *First example of porous alumina used as a label-free optical biosensor. Cited 182 times.*
17. Andrew, J. S.; Anglin, E. J.; Wu, E. C.; Chen, M. Y.; Cheng, L.; Freeman, W. R.; Sailor, M. J., "Sustained Release of a Monoclonal Antibody from Electrochemically Prepared Mesoporous Silicon Oxide." *Adv. Funct. Mater.* **2010**, *20*, 4168–4174. *First demonstration of loading and controlled release of the antibody bevacizumab (Avastin) from a porous SiO_2 carrier. Bevacizumab is a common injectable therapeutic for cancer and for age*

related macular degeneration. Because of their large size and susceptibility to denaturation, antibodies have been difficult to formulate in most other controlled release drug delivery materials. Comprises one of the core technologies of Spinnaker Biosciences, inc. Cited 94 times.

18. Gu, L.; Ruff, L. E.; Qin, Z.; Corr, M.; Hedrick, S. M.; Sailor, M. J., "Multivalent Porous Silicon Nanoparticles Enhance the Immune Activation Potency of Agonistic CD40 Antibody." *Adv. Mater.* **2012**, *24*, 3981-3987. *First demonstration of immune system activation by porous Si nanoparticles. Showed the ability of porous Si nanoparticles to act as multivalent hosts to enhance the binding to, and activation of, immune b-cells. Cited 97 times.*

19. Gu, L.; Hall, D. J.; Qin, Z.; Anglin, E.; Joo, J.; Mooney, D. J.; Howell, S. B.; Sailor, M. J., "In vivo time-gated fluorescence imaging with biodegradable luminescent porous silicon nanoparticles." *Nat. Commun*. **2013**, *4*, 2326. *First example of time-gated imaging of porous Si nanoparticles in-vivo. Demonstrated elimination of interfering light emission from organic chromophores and tissue autofluorescence*. *Cited 349 times.*

20. Li, X.; Gu, M.; Hu, S.; Kennard, R.; Yan, P.; Chen, X.; Wang, C.; Sailor, M. J.; Zhang, J.-G.; Liu, J. "Mesoporous silicon sponge as an anti-pulverization structure for high-performance lithium-ion battery anodes." *Nat. Commun.* **2014**, *5*, 4105. DOI: 10.1038/ncomms5105. *Discovery that mesoporous silicon significantly improves Li-ion battery performance. While it was predicted that silicon could display 10 times the energy storage capacity of graphite as the anode in a Li-ion battery, development of a silicon-based Li-ion battery was hindered by low cycle life, caused by the massive volume changes (300%) the material undergoes with each charge/discharge cycle as lithium enters and exits the fragile silicon lattice. In collaboration with Jason Zhang at the Pacific Northwest National Laboratory, we developed a mesoporous form of silicon that resulted in volume expansion during lithiation of only 30%, which resulted in a capacity of ~750 mAh/g based on total electrode weight, and > 80% capacity retention over 1000 cycles. All of these metrics were significant improvements over the state of the art for silicon at that time. Cited 666 times.*

21. Kim, D.; Zuidema, J. M.; Kang, J.; Pan, Y.; Wu, L.; Warther, D.; Arkles, B.; Sailor, M. J., "Facile Surface Modification of Hydroxylated Silicon Nanostructures Using Heterocyclic Silanes." *J. Am. Chem. Soc.* **2016,** *138*, 15106-15109. *Introduced a new means to quickly and efficiently modify nanoparticle surfaces using heterocyclic silane reagents. Cited 77 times.*

22. Hussain, S.; Joo, J.; Kang, J.; Kim, B.; Braun, G. B.; She, Z.-G.; Kim, D.; Mann, A. P.; Mölder, T.; Teesalu, T.; Carnazza, S.; Guglielmino, S.; Sailor, M. J.; Ruoslahti, E., "Antibiotic-loaded nanoparticles targeted to the site of infection enhance antibacterial efficacy." *Nat. Biomed. Eng.* **2018,** *2*, 95–103. *First time a peptide-targeted nanoparticle delivery system was shown to improve efficacy of a first-line antibiotic in treating a drug resistant strain of Staph. aureus. Demonstrated in mouse lung and skin infection models. Showed the advantage of selective tissue targeting (by peptides) and the use of nanoporous delivery vehicle to improve performance of a conventional antibiotic Cited 278 times.*

23. Kim, B.; Pang, H.-B.; Kang, J.; Park, J.-H.; Ruoslahti, E.; Sailor, M. J., "Immunogene therapy with fusogenic nanoparticles modulates macrophage response to Staphylococcus

aureus." *Nat. Commun.* **2018,** *9*, 1969. *Using a nanotherapeutic to deliver siRNA that targets cells in the immune system, this paper represents the first time an siRNA therapeutic was fully effective against a lethal bacterial infection of any kind. Demonstrated on a Staph. aureus pneumonia model in mice. Cited 145 times.*

24. Zuidema, J. M.; Kumeria, T.; Kim, D.; Kang, J.; Wang, J.; Hollett, G.; Zhang, X.; Roberts, D. S.; Chan, N.; Dowling, C.; Blanco-Suarez, E.; Allen, N. J.; Tuszynski, M. H.; Sailor, M. J., "Oriented Nanofibrous Polymer Scaffolds Containing Protein-Loaded Porous Silicon Generated by Spray Nebulization." *Adv. Mater.* **2018,** *30*, 1706785. *Important because it demonstrated the ability to formulate sensitive protein therapeutics into common drug delivery polymers without substantial degradation of activity. Cited 41 times.*

25. Vijayakumar, S.; Alberstein, R. G.; Zhang, Z.; Lu, Y.-S.; Chan, A.; Wahl, C. E.; Ha, J. S.; Hunka, D. E.; Boss, G. R.; Sailor, M. J.; Tezcan, F. A. Designed 2D protein crystals as dynamic molecular gatekeepers for a solid-state device. *Nat. Commun.* **2024**, *15*, 6326. DOI: 10.1038/s41467-024-50567-8. *Proteins feature prominently in a number of important technologies, such as blood sugar monitors, rapid antigen assays for disease diagnosis, and DNA sequencing devices. A major challenge with all of these is the need to preserve the function of the protein, even though it is operating in a non-natural environment. This work demonstrates an engineered protein that operates in an open air environment, as a gatekeeper for admission of molecules into a solid state sensor device.*