Quadrennial Review of the National Nanotechnology Initiative (2025)

Committee

Vicki L. Colvin

Chair

Dr. Vicki Colvin joined LSU in 2024 as dean of the LSU College of Engineering and the Bert S. Turner Chair. Previously, she was the Victor Kreible Professor of Chemistry and Engineering at Brown University and Director of its Institute for Biology, Engineering, and Medicine (I-BEAM). Before her return to academic research and teaching, she served as Brown's Provost from 2014-15 and as Rice University's Vice-Provost for Research from 2010-2014. She is an expert in nanoscience and nanotechnology, materials interactions with biology and the environment, and advanced optical and magnetic materials. She received her undergraduate degree in Chemistry and Physics from Stanford University in 1988 and her PhD in Chemistry from U. C. Berkeley in 1994. She has previously served on a NAS study on NNI research related to nanotechnology's safety and has testified twice before the US Congress on science policy and nanotechnology. Dr. Colvin was from 2001 - 2011 the Director of the NSF Center for Biomedical and Environmental Nanotechnology (CBEN) the nation's first center devoted to the study of the human health and environmental applications and implications of nanotechnology. Her graduate work on quantum dots and light-emitting diodes laid the foundation for developing quantum dot television sets and related optical devices. She has published over 200 peer-reviewed papers, holds seven patents, and is a fellow of AIMBE and AAAS. She has been named a Sloan Foundation Fellow and a Chemistry of Materials Highly Cited Researcher, among other awards. She currently serves as an associate editor for the ACS journal Nano Letters, a board member of the non-profit Schlumberger Foundation which supports the international Faculty for the Future program, and has founded a company Rhode Island Nanotechnology that provides expert evaluation of nanotechnology-related intellectual property.

Omolola (Lola) Eniola Adefeso

Member

Dr. Omolola Eniola-Adefeso is the Dean of the College of Engineering at University of Illinois-Chicago. She was previously the Vennema Endowed Professor of Chemical Engineering and the University Diversity and Social Transformation Professor of Chemical Engineering and Biomedical Engineering at the University of Michigan-Ann Arbor. She received a doctoral
degree (2004) in Chemical and Biomolecular Engineering at the University of Pennsylvania. She was a postdoctoral associate in Pediatrics/Leukocyte Biology at Baylor College of Medicine. Dr. Eniola-Adefeso joined the faculty of Chemical Engineering at the University of Michigan in 2006, where she runs the Cell Adhesion and Drug Delivery Laboratory. Since she arrived at
Michigan, Dr. Eniola-Adefeso has received several honors and awards, including the NSF CAREER Award, American Heart Association (AHA) Innovator Award, and most recently, the Biomedical Engineering Society (BMES) MIDCAREER Award. She is a fellow of the American Institute for Medical and Biological Engineering (AIMBE), the Biomedical Engineering Society,
the American Heart Association, the Controlled Release Society (CRS), a senior member of the National Academy of Inventors (NAI), and serves as Deputy Editor for Science Advances. Additionally, she was recently elected to a two-year term as the president of AIMBE. Her research is currently funded by multiple grants from the NIH NHLBI, American Heart
Association, and the National Science Foundation.

Craig Arnold

Member

Professor Craig B. Arnold is currently Vice Dean for Innovation at Princeton University and the Susan Dod Brown Professor of Mechanical and Aerospace Engineering and Materials Science. Prior to his service as the Vice Dean for innovation, he was the director of the Princeton Materials Institute for 7 years where he oversaw Princeton’s micro and nanofabrication facility and their imaging and analysis center. Arnold’s research focuses on materials processing, including advanced manufacturing and nanostructuring of materials and he is a fellow of SPIE and Optica. Prof. Arnold received his B.S. in Physics and Math from Haverford College and his A.M and Ph.D from Harvard University in Physics. Arnold currently serves on the National Academies National Materials and Manufacturing Board.

Angela M. Belcher

Member

Angela Belcher is a biological and materials engineer with expertise in the fields of biomaterials, biomolecular materials, organic-inorganic interfaces and solid-state chemistry and devices. Her primary research focus is evolving new materials for energy, electronics, the environment, and medicine. She received her B.S. in Creative Studies from The University of California, Santa Barbara. She earned a Ph.D. in inorganic chemistry at UCSB. Following with her postdoctoral research in electrical engineering at UCSB. She now holds the James Mason Crafts Professor of Biological Engineering and Materials Engineering at MIT. She is faculty in the Department of Biological Engineering, Materials Science and Engineering and the Koch Institute of Integrative Cancer Research. She teaches undergraduate subjects in material sciences and engineering and biological engineering. In 2002, she founded the company Cambrios Technologies, Inc., and in 2007 she founded Siluria Technologies, Inc. Some recent awards include the Lemelson-MIT Prize for her Inventions, Eni Prize for Renewable and Non-Conventional Energy, in 2009 Rolling Stone Magazine listed her as one of the top 100 people changing the country. In 2007, Time Magazine named her a “Hero”- for her research related to Climate Change. Additionally, she has received many other prestigious awards and is a MacArthur Fellow, a Packard Fellow, an Alfred P. Sloan Fellow, a Bose Fellow, a member of American Academy of Arts and Sciences, a member of the National Academy of Inventors, a member of the National Academy of Engineering and a member of the National Academy of Sciences.

Stacey F. Bent

Member

Stacey F. Bent is the Jagdeep and Roshni Singh Professor at Stanford University, where she is Professor of Chemical Engineering, Professor of Energy Science and Engineering, and Professor, by courtesy, of Chemistry, of Materials Science and Engineering, and of Electrical Engineering. She also currently serves as Vice Provost for Graduate Education and Postdoctoral Affairs. Prior to Stanford, Bent was on the faculty of the Chemistry Department at New York University. Bent obtained her B.S. degree in chemical engineering from UC Berkeley and her Ph.D. degree in chemistry from Stanford, and she was a postdoctoral fellow at AT&T Bell Laboratories. Bent’s research interests are in the understanding of surface chemistry and materials synthesis and the application of this knowledge to a variety of problems in sustainable energy, semiconductor processing, and nanotechnology. She has published over 300 papers and has presented over 350 invited talks. Bent was elected to the U.S. National Academy of Engineering in 2020. She is also a Fellow of the American Chemical Society (ACS) and the American Vacuum Society (AVS), and the recipient of the 2018 ACS Award in Surface Chemistry, the 2020 SRC Technical Excellence Award, the 2021 ALD Innovator Award, and the 2021 Braskem Award for Excellence in Materials Engineering and Science from AIChE.

Harold G. Craighead

Member

Dr. Harold Craighead (NAE) is Professor Emeritus of Applied and Engineering Physics and the Charles Lake Jr. Chaired Professor Emeritus of Engineering at Cornell University. He received his Ph.D. in Physics in 1980 after which he became a Member of Technical Staff at Bell Laboratories and a Research Manager at Bellcore where he formed the Quantum Structures Research Group. At Cornell Dr. Craighead served as the Director of the National Nanofabrication Facility, founding Director of the Nanobiotechnology Center, PI for the Center on the Microenvironment and Metastasis, Interim Dean of Engineering, and he is a member of the National Academy of Engineering and the National Academy of Inventors. In 2000 he co-founded the company Nanofluidics, Inc. that is now Pacific Biosciences of California, Inc, a company based on single molecule DNA sequencing technology. His research focused on investigating the fabrication and properties of nano-scale devices and developing new approaches for biomolecular analysis. Research projects include studies of single molecule biophysics, chemical sensors, biomolecular analysis, surface chemical patterning, and the physics of nanoelectromechanical systems. Dr. Craighead was a member of the Committee on the National Academies of Sciences, Engineering, and Medicine 2020 Quadrennial Review of the National Nanotechnology Initiative: Nanoscience, Applications, and Commercialization.

Travis Earles

Member

Travis Earles is the managing partner of Sonder.Works. He previously lead tech strategy and innovation for Lockheed Martin (LM) Space, developing technology roadmaps, innovation initiatives, and strategic partnerships critical for securing discriminating capabilities for enterprise platforms and system elements. From 2019-2021, he led far-reaching innovation for LM by cultivating a wholistic ecosystem to drive an agile process of ideation to implementation. From 2016-2019, Earles established the digital transformation structure and operations strategy for LM Rotary & Mission Systems, ensuring talent and emerging technologies are aligned to support production, sustainment, and base growth and driving digital transformation towards the future enterprise. Prior to 2016, Earles led advanced materials and nanotechnology innovation across LM. Before joining Lockheed in 2011, Earles led nanotechnology and emerging tech policy in the White House Office of Science & Technology Policy overseeing interagency coordination of the $1.8B U.S. National Nanotechnology Initiative. At the National Cancer Institute until 2007, Earles played a central role launching the $144 million Alliance for Nanotechnology in Cancer, which has generated over 70 platforms now in clinical use or trials for diagnostic and/or therapeutic applications. His formal training is in biomedical engineering, and he also holds a masters in technology management and an MBA from University of Maryland.

Y. Shirley Meng

Member

Dr. Y. Shirley Meng is a Professor at the Pritzker School of Molecular Engineering at the University of Chicago. She serves as the Chief Scientist of the Argonne Collaborative Center for Energy Storage Science (ACCESS) Argonne National Laboratory. Dr. Meng is the principal investigator of the research group - Laboratory for Energy Storage and Conversion (LESC), that was established at University of California San Diego since 2009. She held the Zable Chair Professor in Energy Technologies at University of California San Diego (UCSD) from 2017-2022. Dr. Meng received several prestigious awards, including the C3E technology and innovation award (2022), the Faraday Medal of Royal Chemistry Society (2020), and many others. Dr. Meng is elected Fellow of Electrochemical Society (FECS), Fellow of Materials Research Society (FMRS) and Fellow of American Association for the Advancement of Science (AAAS). She is the author and co-author of more than 300 peer-reviewed journal articles, two book chapters and eight issued patents. She is the Editor-in-Chief for Materials Research Society MRS Energy & Sustainability. Dr. Meng received her Ph.D. in Advance Materials for Micro & Nano Systems from the Singapore-MIT Alliance in 2005. She received her bachelor's degree in Materials Science with first class honor from Nanyang Technological University of Singapore in 2000. Dr. Meng is a member of the Basic Energy Science Advisory Committee for DOE Office of Science, she actively participated in the report " CAN THE U.S. COMPETE in Basic Energy Sciences? CRITICAL RESEARCH FRONTIERS AND STRATEGIES" in 2021.

Christine Payne

Member

Prof. Christine Payne is the Yoh Family Professor of Mechanical Engineering and Materials Science at Duke University. She began her independent career in the School of Chemistry and Biochemistry at Georgia Tech in 2007 and moved to Duke University in 2018. Her research focuses on understanding how cells interact with nanomaterials. This includes fundamental questions of nanoparticle transport within cells, as well as applied research to understand the pulmonary response to the inhalation of nanoparticles in a manufacturing setting. Her team uses an interdisciplinary approach that includes elements of materials science, chemistry, biophysics, and lab automation. Dr. Payne has received many honors including an NIH Director's New Innovator Award in 2009 and a DARPA Young Faculty Award in 2011. She is a Fellow of the Royal Society of Chemistry and a member of RSC, ACS, BPS, MRS, and ASME. She will serve as a Jefferson Science Fellow with the U.S. Department of State in 2024. She earned a B.S. in Chemistry from the University of Chicago (1998) and a Ph.D. in Chemistry from the University of California, Berkeley (2003). Prof. Payne spent 2003-2006 as an NIH NRSA Postdoctoral Fellow at Harvard University.

Ricardo Ruiz

Member

Ricardo Ruiz is a staff scientist at The Molecular Foundry at Lawrence Berkeley National Laboratory. He is also the Director of the Center for High Precision Patterning Science (CHiPPS), a DOE-BES funded Energy Frontier Research Center dedicated to advance patterning science in the Extreme Ultraviolet lithography era for semiconductor manufacturing. Dr. Ruiz is an expert on nanofabrication, patterning and self-assembly with 15 years of experience in the magnetic storage and semiconductor memory industry. From 2006 to 2019 he held various appointments at Hitachi GST/ HGST/ Western Digital where he contributed to magnetic bit patterned media and non-volatile memories, and he managed a research Group dedicated to block copolymer and nanoparticle lithography. Dr. Ruiz is a fellow of the American Physical Society. He received his PhD in Physics from Vanderbilt University in 2003 and he was a postdoctoral fellow at Cornell University and at IBM T.J. Watson. Dr. Ruiz previously served on the National Academies' committee for the Quadrennial Review of the National Nanotechnology Initiative in 2019.

Michael G. Spencer

Member

Professor Michael G Spencer is currently Prof. and Chair in the Dept of Electrical and Computer Engr. at Morgan State University. He is also a Professor Emeritus in the Dept. of Electrical and Computer Engr. at Cornell University. At Cornell Spencer served as associate Dean for the College of Engineering. Prof. Spencer has expertise in electronic materials principally wide bandgap materials Silicon Carbide, Gallium Nitride and cubic Boron Nitride. Also 2D materials such as graphene. Prior to teaching at Cornell Spencer taught at Howard University where he co-founded and ran the Material Science Center of Excellence which was a member of the first National Nanofabrication Network. Professor Spencer received his B.S, M.Eng and Ph.D from Cornell University.

Jesse B. Tice

Member

Dr. Jesse Tice is currently a Consulting Research Scientist at Northrop Grumman Corporation. He has expertise in nanomaterials and nanotechnology research and development as it relates to aerospace systems. While at Northrop Grumman, he oversees a nanomaterials research laboratory, and nanotechnology research portfolio that includes both basic research and applied technology development. Dr. Tice bridges the gap between academic research, small business innovation, and industrial application to both air and space platforms. He has participated in the National Academy of Engineering Frontiers of Engineering Symposium. He has been recognized with many innovation accolades at Northrop Grumman during his tenure including invention recognitions and President's awards. Dr. Tice received his Ph.D. from Arizona State University School of Molecular Sciences in 2008. He has over 65 publications and patents with >1300 citations including review articles related to two-dimensional materials and nanomaterials with applications in aerospace.

Catherine J. Murphy

Vice Chair

Catherine J. Murphy is the Larry R. Faulkner Endowed Chair in Chemistry and current Interim Director of the Beckman Institute for Advanced Science and Technology at the University of Illinois Urbana-Champaign (UIUC). Prior to her appointment at UIUC in 2009, she was on the faculty of chemistry and biochemistry at the University of South Carolina. Dr. Murphy has pioneered the colloidal synthesis of shape-controlled gold nanocrystals in aqueous solution in the 5-100 nm size range, which enables applications in chemical sensing, biological imaging, optical displays, enhanced energy conversion, mechanically improved polymer nanocomposites and photothermal ablation of pathogenic cells. Murphy's honors include the 2022 Centenary Prize of the Royal Society of Chemistry, the 2020 ACS Award in Inorganic Chemistry, among others. She is a member of the U.S. National Academy of Sciences and a member of the American Academy of Arts and Sciences. Dr. Murphy earned two B.S. degrees, one in chemistry and one in biochemistry from UIUC in 1986, and her Ph.D. in chemistry from the University of Wisconsin, Madison, in 1990. Dr. Murphy is an Associate Editor for Chemistry, and a member of the Editorial Board, for the Proceedings of the National Academy of Sciences. She is a member of the Board of Directors of the Research Corporation for Science Advancement, the Scientific Advisory Board of the Welch Foundation, and Dow's Science and Technology Advisory Council. Dr. Murphy is a coauthor of the best-selling general chemistry textbook Chemistry: The Central Science, from the 10th to the present 15th edition.