Developing Wearable Technologies to Advance Understanding of Precision Environmental Health

A Collaborative Virtual Workshop of
The Standing Committee on the Use of Emerging Science for Environmental Health Decisions
and
The Board on Human Systems Integration

June 1-2, 2023 1-4pm ET
FOR REGISTRATION AND MORE INFORMATION, PLEASE VISIT THE WORKSHOP WEBSITE
ALL TIMES LISTED ARE IN EASTERN TIME

From coast to coast, technology is becoming more integrated into daily life. Now, cutting edge technologies, like wearable devices, can be used to spur progress in the biomedical and environmental health fields. In this workshop, experts will discuss emerging applications of wearable technologies and the latest research and advancements in wearable technology for capturing, monitoring, and predicting environmental exposures and risks to inform precision environmental health. Additionally, the workshop will explore other areas such as disease monitoring, interventions, and biomedicine, and discuss technology adoption, implementation, and science communication for advancing biomedical and environmental health research.

Workshop Agenda

DAY 1: June 1, 2023, 1:00pm-4:00pm Eastern Time

1:00 Welcome and Opening Remarks

Kristen Malecki†, University of Illinois at Chicago
Rick Woychik, National Institute of Environmental Health Sciences

1:15 Keynote Address: Wearables and their Potential in Environmental Health and Biomedical Research

Session Moderator: **Tiffani Bailey Lash*,** National Institute of Biomedical Imaging and Bioengineering
Cristina Davis, University of California, Davis

1:30 Keynote Q&A (15 minutes)

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† Member of the workshop organizing committee

SESSION 1: Capturing, monitoring, and predicting environmental exposures, hazards, and risks to inform precision environmental health

This session will explore the use of advanced technologies for monitoring and predicting environmental exposures and risks to inform health. Experts will discuss the latest technological advances and share strategies for advancing precision environmental health research.

Session Moderator: **Yuxia Cui*,** National Institute of Environmental Health Sciences

1:45 Plenary Speakers

Sameer Halai, WeHealth

Bijan Najafi, Baylor College of Medicine

Natalie Johnson, Texas A&M University

2:30 Session 1 Discussion Q&A (20 minutes)

SESSION 2: Using wearables to advance research for dynamic and real-time measurements of environmental exposures

Speakers in this session will discuss opportunities and share innovative strategies to improve understanding of the health impacts of environmental exposures through dynamic, real-time wearable data. The goal is to identify opportunities for research and strategies for measuring environmental exposures in real-time.

Session Moderator: **Paloma Beamer***†, University of Arizona

2:50 Plenary Speakers

Ana Rappold, Environmental Protection Agency

Kevin Lanza, UTHealth School of Public Health

David Noren & Sara Mariani, Philips

3:35 Session 2 Q&A Discussion (20 minutes)

3:55 Day 1 Closing Remarks
Rima Habre*†, Keck School of Medicine of the University of Southern California

4:00 Adjourn Day 1

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Day 2: June 2, 2023, 1:00pm-4:00pm Eastern Time

1:00 Welcome and Opening Remarks

Kristen Malecki†, University of Illinois at Chicago

SESSION 3: Exploring wearable applications in other research areas such as disease monitoring, interventions, and biomedicine

Speakers in this session will discuss recent advances in medical technology and share experiences in using wearables for disease management. The goal is to broaden the understanding of the potential of wearables and identify new opportunities for research in healthcare and beyond.

Session Moderator: **Akane Sano*,** Rice University

1:05 Plenary Speakers

Shruthi Mahalingaiah & Lauren Cheung, Harvard University & Apple

Jessilyn Dunn, Duke University

David Armstrong, Keck School of Medicine of the University of Southern California

Veena Misra, North Carolina State University

1:45 Session 3 Q&A Discussion (15 minutes)

SESSION 4: Panel Discussion: Understanding how technology adoption, implementation, and science communication factor in advancing biomedical and environmental health research

Experts from academia, industry, and government will share their insights on the challenges and opportunities of adopting new tools, implementing technology, and communicating scientific discoveries to advance environmental health and biomedical research. The goal of this session is to foster a discussion that will help to identify strategies for effectively translating research, adopting technology, and communicating information.

Session Moderator: **Jennifer Horney*,** University of Delaware**; Treye Thomas†,** US Consumer Product Safety Commission

2:00 Panel Discussion with Speakers and Invited Panelists

Panel 1: User Perspective (one-to-one application)

Nita Farahany, Duke University

Ritika R. Chaturvedi, University of Southern California

Shekhar Bhansali, Florida International University

Panel 2: Systems Perspective

Stephanie Russo Carroll, University of Arizona

Tiffany Powell-Wiley, National Institute of Health

Deborah Prince, UL Standards & Engagement

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2:55 All Panelist Q&A (20 minutes)

SESSION 5: Group Discussion: Identifying Research Gaps, Limitations, and Future Directions for Wearables in Environmental Health and Biomedical Research

This group discussion will identify research gaps and limitations in wearables for environmental health and biomedical research and propose future directions for advancing this field. Participants will explore new technologies and interdisciplinary collaborations to improve health outcomes and inform decision-making.

Discussion Moderator: **Rima Habre*†,** Keck School of Medicine of the University of Southern California

3:15 Group Discussion with Invited Panelists

Joseph Wang, University of California, San Diego

Ed Ramos, Scripps Research

3:45 Closing Remarks -- **Rima Habre*†**, University of Southern California

4:00 Adjourn Workshop

Workshop Organizing Committee

This workshop was organized by the following experts: **Rima Habre (Workshop Chair)**, Keck School of Medicine of the University of Southern California; **Paloma Beamer,** University of Arizona; **Yuxia Cui,** National Institute of Environmental Health Sciences; **Amy Wagoner Johnson**, University of Illinois Urbana-Champaign; **Jennifer Horney,** University of Delaware; **Tiffani Bailey Lash**, National Institute of Biomedical Imaging and Bioengineering; **Akane Sano**, Rice University

About Us

The National Academies' Standing Committee on the Use of Emerging Science for Environmental Health Decisions (ESEHD) examines and discusses issues on the use of new science, tools, and research methodologies for environmental health decisions. The ESEHD committee is organized under the auspices of Board on Life Sciences and the Board on Environmental Studies and Toxicology of the National Academies of Sciences, Engineering, and Medicine, and sponsored by the National Institute of Environmental Health Sciences.

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David Armstrong

Dr. Armstrong is Professor of Surgery with Tenure at the University of Southern California. Dr. Armstrong holds a Master of Science in Tissue Repair and Wound Healing from the University of Wales College of Medicine and a PhD from the University of Manchester College of Medicine, where he was appointed Visiting Professor of Medicine. He is founder and co-Director of the Southwestern Academic Limb Salvage Alliance (SALSA). Dr. Armstrong has produced more than 640 peer-reviewed research papers in dozens of scholarly medical journals as well as over 100 books or book chapters. He is founding co- Editor of the American Diabetes Association's (ADA) Clinical Care of the Diabetic Foot, now entering its fourth edition.

Dr. Armstrong is Director of USC's National Science Foundation (NSF) funded Center to Stream Healthcare in Place (C2SHiP) which places him at the nexus of the merger of consumer electronics, wearables, and medical devices in an effort to maximize hospital-free and activity-rich days.

Dr. Armstrong was selected as one of the first six International Wound Care Ambassadors and is the recipient of numerous awards and degrees by universities and international medical organizations including the inaugural Georgetown Distinguished Award for Diabetic Limb Salvage. In 2008, he was the 25th and youngest-ever member elected to the Podiatric Medicine Hall of Fame. He was the first surgeon to be appointed University Distinguished Outreach Professor at the University of Arizona. He was also the first podiatric surgeon to be selected as President.

Shekhar Bhansali

Shekhar Bhansali is a Lucent Technologies CALA Distinguished University Professor at the Florida International University, having previously served as the Director of the U.S. National Science Foundation Division of Electrical, Communications, and Cyber Systems for two years. Bhansali's expertise is in the field of biosensors, microfluidics, nanostructured catalysts, and microsystems. He has a background in developing microfluidic tools for DNA damage detection, 3D multicellular spheroid monitoring, real-time biomarker monitoring, automated cell health monitoring, cardiovascular diagnostic sensors, and many other diagnostic devices. He has been recognized for his mentoring through multiple awards, including the Alfred P. Sloan Foundation Mentor of the Year Award. He is also an active member of the Institute of Electrical and Electronics Engineers (IEEE) and a Fellow of the American Association for the Advancement of Science and the National Academy of Inventors.

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Stephanie Carroll Russo

Dr. Stephanie Carroll is a citizen of the Native Village of Kluti-Kaah in Alaska and of Sicilian-descent. At the University of Arizona, she is Assistant Professor of Public Health, Associate Director for the Native Nations Institute, and Acting Director/Assistant Research Professor at the Udall Center. Her research group, the Collaboratory for Indigenous Data Governance, develops research, policy, and practice innovations for Indigenous data sovereignty. Her research, teaching, and engagement seek to transform institutional governance and ethics for Indigenous control of Indigenous data, particularly within open science, open data, and big data contexts. Stephanie co-edited the book Indigenous Data Sovereignty and Policy and led the publication of the CARE Principles for Indigenous Data Governance. Stephanie co-founded the US Indigenous Data Sovereignty Network and co-founded and chairs the Global Indigenous Data Alliance (GIDA), the International Indigenous Data Sovereignty Interest Group at the Research Data Alliance, and the Indigenous Data Working Group for the IEEE P2890 Recommended Practice for Provenance of Indigenous Peoples' Data. Stephanie is a founding board member for the Copper River Tribal College in Chitina, Alaska. She received her AB from Cornell University and MPH and DrPH from the University of Arizona.

Ritika R. Chaturvedi

Dr. Ritika Chaturvedi is a biomedical engineer at the USC Schaeffer Center for Health Policy and Economics. She has a diverse background in engineering, science and technology policy, asset valuation, strategic consulting, and translational biomedical research. Her research involves improving fairness and equity in precision digital health. She currently leads the American Life in Realtime study involving Fitbit collection from a large representative sample of UAS participants. Established using FAIR (Findable, Accessible, Interoperable, reusable) standards, ALiR serves as a benchmark cohort and dataset for the digital health community to improve transparency and validity in digital health model development.

Lauren Cheung

Dr. Lauren Cheung is a physician on the Health team at Apple working across health initiatives and is passionate about its mission toward empowering users to live better and healthier lives. She continues to care for patients as a faculty member at Stanford Medicine. Dr. Cheung was a co-founder of the Stanford Center for Digital Health and played a large role in the implementation and roll-out of telemedicine and digital health across Stanford. She completed her BA at Brown, her post-baccalaureate at Harvard, and her Doctor of Medicine and MBA at UC Irvine.

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Cristina Davis

Dr. Cristina Davis is a Professor and Chair of the Department of Mechanical and Aerospace Engineering of the University of California, Davis. Her research centers around chemical sensing for biological applications, by both developing novel miniature gas phase chemical sensors as well as defining relevant volatile organic compound (VOC) metabolomics biomarkers of interest in human, animal and plant systems. She has been a fellow for multiple highly esteemed organizations, including the American Institute for Medical and Biological Engineering, the American Association for the Advancement of Science, the National Academy of Inventors, and a member of the United States Air Force Scientific Advisory Board. In 2008, she was selected for the National Academies Keck Futures Initiative, and 2011 for National Academy of Engineering 17th Annual Frontiers of Engineering Education Symposium. Lastly, since 2018, she has been an ad hoc member of the Intelligence Science and Technology Experts Group which is administered by the Intelligence Community Studies Board of the National Academies.

Jessilyn Dunn

Dr. Jessilyn Dunn is an Assistant Professor of Biomedical Engineering and Biostatistics & Bioinformatics at Duke University. Her work includes multi-omics, wearable sensor, and electronic health records integration and digital biomarker discovery. Dr. Dunn is the Director of the BIG IDEAs Laboratory, whose goal is to detect, treat, and prevent chronic and acute diseases through digital health innovation. She is also currently PI of the CovIdentify study to detect and monitor COVID-19 using mobile health technologies. Dr. Dunn was an NIH Big Data to Knowledge Postdoctoral Fellow at Stanford and an NSF Graduate Research Fellow at Georgia Tech and Emory, as well as a visiting scholar at the US Centers for Disease Control and Prevention and the National Cardiovascular Research Institute in Madrid, Spain. Her work has been internationally recognized with media coverage from the NIH Director's Blog to Wired, Time, and US News and World Report.

Nita Farahany

Nita Farahany is a leading scholar on the ethical, legal, and social implications of emerging technologies. She is the Robinson O. Everett Distinguished Professor of Law & Philosophy at Duke Law School, the Founding Director of Duke Science & Society, the Faculty Chair of the Duke MA in Bioethics & Science Policy, and principal investigator of SLAP Lab. Her current scholarship focuses on the implications of emerging neuroscience, genomics, and artificial intelligence for law and society; legal and bioethical issues arising from the COVID-19 pandemic; FDA law and policy; and the use of science and technology in criminal law. In addition to publishing in legal and scientific journals, as well as edited book volumes, Farahany is the author of the book *The Battle for Your Brain: Defending Your Right to Think Freely in the Age of Neurotechnology*. In 2010,

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Professor Farahany was appointed by President Obama to the Presidential Commission for the Study of Bioethical Issues and served until 2017. Farahany received her AB in Genetics, Cell, and Developmental Biology from Dartmouth College, an ALM in biology from Harvard University, and a JD and MA from Duke University, as well as a Ph.D. in philosophy.

Sameer Halai

Sameer Halai is the CEO of Wehealth, a public benefit corporation, started as a response to the pandemic. Its mission is provide the infrastructure for public health preparedness with monitoring, mitigation and trusted communication for all hazard risks. Wehealth powers solutions for the State of Arizona, the Nation of Bermuda and works directly with Universities, Tribal Nations and Local Public Health Departments. Wehealth provides a turnkey, automated, privacy preserving, decentralized contact tracing solution that uses Google Apple Exposure Notification system and is working on extending the protocol using stationery hardware beacons, sensors and non-smartphone wearables. Halai has founded several VC-backed startups in health, climate change & finance, raised $150M+ in venture capital & debt and has had 2 exits (IPO/acquisition). His focus is on Product Design and Human-Computer Interaction spanning commercial global scale products at Microsoft as well as R&D projects at the Future Social Experiences Lab at Microsoft Research and the Visual Communication Lab at IBM Research.

Natalie Johnson

Dr. Natalie Johnson is an Associate Professor in the Department of Environmental & Occupational Health at Texas A&M University. Dr. Johnson obtained her Ph.D. in Toxicology from Texas A&M University. She then completed a post-doctoral fellowship at Johns Hopkins University. Dr. Johnson's current research and translational goals are to identify hazard and characterize exposures to promote solutions to combat air pollution and respiratory disease risks, especially in susceptible populations. Biologically susceptible stages, like pregnancy and childhood impact toxicity and have unique exposure considerations. Vulnerable groups, often Communities of Color, are disproportionately exposed to air pollution, which is compounded by co-exposures to non-chemical stressors, like heat, stress from environmental disasters, and other social factors. Dr. Johnson is leading projects funded through NIEHS and the Robert Wood Johnson Foundation to develop novel tools to evaluate hazard and characterize air pollutant mixtures through experimental models and community-based studies.

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Kevin Lanza

Kevin Lanza is an Assistant Professor in Environmental and Occupational Health Sciences at UTHealth School of Public Health in Austin. His research explores the relations between the environment, health behaviors, and health through an equity lens, with a focus on extreme heat and physical activity of children and other heat-sensitive populations. The ultimate goal of his research is to inform policies that eliminate health inequities based on race, ethnicity, class, and occupation in the face of climate change. Prior to joining the faculty at UTHealth, Dr. Lanza was a research fellow at the U.S. Centers for Disease Control and Prevention, received his doctorate in City & Regional Planning from Georgia Institute of Technology, and completed his postdoctoral training at the Michael & Susan Dell Center for Healthy Living. His research has been funded by the National Institute of Environmental Health Sciences, National Oceanic and Atmospheric Administration, Robert Wood Johnson Foundation, and City of Austin

Shruthi Mahalingaiah

Shruthi Mahalingaiah is an assistant professor of environmental, reproductive, and women's health at the Harvard T.H. Chan School of Public Health. She serves clinically as a physician at the Massachusetts General Hospital in the Department of Obstetrics and Gynecology, where she specializes in ovulation disorders, reproductive endocrinology, and infertility. Her research seeks to understand the links between environmental and modifiable risk factors on human reproduction and gynecological diseases. Dr. Mahalingaiah is the creator of the Ovulation and Menstruation Health (OM) Study and one of the principal investigators of the Apple Women's Health Study.

Sara Mariani

Sara Mariani is a senior scientist at Philips Research North America, in the department of Connected Care and Personal Health. Since joining Philips in 2018, she has been working on DoD-funded activities focused on early detection of infection and exposure to toxic agents.

Sara's main field of expertise is biomedical signal processing, and she works on the extraction of informative features from waveform data and time series, both from hospital monitors and wearable devices. She was also the PI for the MESH project, that focused on contactless monitoring of respiratory rate and skin temperature at range.

Prior to joining Philips, Sara held a faculty position at Harvard Medical School in the Division of Sleep and Circadian Disorders, devising tools for information extraction and interpretation of sleep/circadian signals. She has a PhD in biomedical engineering from Politecnico di Milano, followed by a 2 year postdoc at the Wyss Institute at Harvard University.

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Veena Misra

Veena Misra is the Director of the National Science Foundation Nanosystems Engineering Research Center on Advanced Self-Powered of Integrated Sensors and Technologies (ASSIST). While her background and training as an electrical engineer is on advanced high performance silicon devices, she has spent the last 15 years of her career in integrating these technologies with non-traditional technologies both in structure and in functionality. She is a Distinguished Professor of Electrical and Computer Engineering at North Carolina State University and a 2012 IEEE Fellow. She has authored or coauthored over 150 papers in the areas of state-of-the-art low-power devices, nanoscale magnetics, and energy-harvesting. Dr. Misra was the recipient of the 2001 National Science Foundation Presidential Early CAREER Award, the 2011 Alcoa Distinguished Engineering Research Award, and 2007 Outstanding Alumni Research Award and the 2016 R.J. Reynolds Award.

Bijan Najafi

Dr. Bijan Najafi, a Professor of Surgery at Baylor College of Medicine, specializes in digital health and biotechnologies. He serves as the Director of Clinical Research in Vascular Surgery and Endovascular Therapy, Director of the National Science Foundation's Center for Streamed Healthcare in Place (C2SHIP), and Co-founder/Director of the Interdisciplinary Consortium on Advanced Motion Performance (iCAMP). In 2014, Tucson Local Media recognized him as a Most Influential Health and Medical Leader. With a bioengineering Ph.D. from École Polytechnique Fédérale de Lausanne (EPFL) and a neuroscience postdoc at Harvard, he has published 250+ peer-reviewed articles, earning 14k+ citations. Expertscape ranked him in the top 1% global scholars in 2021 for work on leg ulcers and diabetic peripheral neuropathy. In 2023, he was inducted into the prestigious American Institute for Medical and Biological Engineering (AIMBE) College of Fellows for pioneering digital health technologies that prevent falls and limb gangrene. Throughout his career, he has mentored 500+ students, research fellows, interns, postdocs, and young faculty members.

Dave Noren

David Noren, Ph.D. is a senior scientist at Philips Research North America and has been developing AI centered technology at Philips since 2016. He has led multiple data science teams in both research investigations and in bringing products to market, including serving as principal investigator for AI initiatives funded by the DOD.

David's expertise spans the intersection of AI/ML, biomedical informatics, and healthcare. Prior to joining Philips, David studied the application of AI to leukemia treatment as a National Library of Medicine (NLM) postdoctoral fellow in

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biomedical informatics at Rice University and MD Anderson Cancer Center. He completed a Ph.D. in Biomedical Engineering at Johns Hopkins University in the area of

Tiffany Powell-Wiley

Tiffany M. Powell-Wiley MD, MPH is an Earl Stadtman Investigator and Chief of the Social Determinants of Obesity and Cardiovascular Risk Laboratory at the National Institutes of Health with a joint appointment in the Cardiovascular Branch of the Division of Intramural Research at the National Heart, Lung, and Blood Institute (NHLBI) and the Intramural Research Program of the National Institute on Minority Health and Health Disparities. Dr. Powell-Wiley's interdisciplinary team uses community-engaged research, epidemiologic methods, and translational approaches to better understand social factors that promote obesity and limit cardiovascular health. In 2021, Dr. Powell-Wiley's innovative work was recognized with the American Heart Association's Population Research Prize. In 2023, Dr. Powell-Wiley was chosen for the American Society for Clinical Investigation. At NIH, Dr. Powell-Wiley has mentored more than 50 research fellows at various career stages, several of whom are now tenure-track, NIH-funded faculty. Dr. Powell-Wiley serves as an Associate Editor for the *Journal of the American Heart Association*, as a Consulting Editor for *Health Psychology*, and is on the editorial board for the journal, *Circulation*. She has been recognized through NHLBI Director's awards for her mentorship of research fellows and for promoting diversity in the biomedical workforce through her mentoring efforts. Dr. Powell-Wiley graduated summa cum laude with a B.S.E. in chemical engineering from the University of Michigan in Ann Arbor. She received an M.P.H. in Epidemiology from the University of North Carolina at Chapel Hill. She graduated with an M.D. from Duke University School of Medicine, where she was inducted into the Alpha Omega Alpha Medical Honor Society. Prior to joining NIH, Dr. Powell-Wiley completed internal medicine residency at Brigham and Women's Hospital and cardiology fellowship at the University of Texas Southwestern Medical Center, where she served as the Cardiology Division's first chief fellow.

Deborah Prince

Deborah Prince started her career in Standards with UL in 1995. She worked in Standards operations then in Global Standards where she was involved in implementing the STP standards development process. Currently, she is the Director of Standards Programs, these programs include augmented reality/virtual reality, medical devices, software safety, cyber security and ULSE's autonomous suite of standards which include automotive, heavy trucks, unmanned aerial systems, lidar, and robotics. Deborah holds a BS in Mechanical Engineering from the Missouri University of Science and Technology.

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Ed Ramos

Edward Ramos, Ph.D., is Chief Scientific Officer at CareEvolution and Co-founder of the Digital Trials Center and Director of Digital Clinical Trials at Scripps Research. Dr. Ramos' work is based on the growing need to rethink clinical research studies by leveraging digital health technologies and embracing decentralized, "site-less" approaches, which can promote broad participation without sacrificing robust data collection. Ed's leadership role focuses on overseeing implementation of digital research studies in a variety of research contexts including infectious disease, maternal health, sleep medicine, and precision nutrition (where he serves as the primary investigator). Ed prioritizes efforts to address health disparities and to enhance participation in a diverse, equitable, and inclusive manner. Prior to this dual role, Ed served in the federal government for nearly 15 years. There, he led independent research projects and has been coordinating and administering large-scale national research efforts. His expertise spans population genomics, bioinformatics, mobile health, and digital clinical trials. In his previous positions serving in various capacities at the National Institutes of Health (NIH), Ed oversaw and managed portfolios that focused on innovative and groundbreaking initiatives aimed at improving public health. Most recently, Ed was Team Lead for the Participant Center of the All of Us Research Program, an ambitious program launched by NIH inviting one million people across the U.S. to help build one of the most diverse health databases in history, which could help in the development of better treatments and ways to prevent different diseases. Ed began his federal service as a legislative fellow and legislative assistant, advising then-U.S. Senator Barack Obama on health and science policy. He received his Ph.D. in molecular biotechnology from the University of Washington with his thesis work carried out at the Fred Hutchinson Cancer Research Center.

Ana Rappold

Dr. Ana Rappold is a Statistician and a Clinical Research Branch Chief at the US EPA. Ana conducts clinical and epidemiological research on health effects from air pollution and other environmental exposures and has authored several studies specific to wildfire smoke impacts on cardiopulmonary health. Ana received a 2019 Arthur S. Flemming Award for the Smoke Sense Project, a smartphone citizen science app that seeks to answer how people experience wildfire smoke and builds community around health protective behaviors in the face of exposures.

Joseph Wang

Joseph Wang is a Distinguished Professor, SAIC Endowed Professor at the Department of Nanoegineering at University of California San Diego (UCSD), USA. After holding a Regents Professor and Manasse Chair positions at NMSU he moved to

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ASU where he served as the Director of the Center for Bioelectronics and Biosensors (Biodesign Institute). He joined the UCSD NanoEngineering Dept. in 2008. He is a member of the US National Academy of Inventors and of the Turkish National Academy of Sciences. Wang holds Honorary Professor from 8 different universities and is the recipient of 2 National American Chemical Society Awards for Electrochemistry and Instrumentation of the Electrochemical Society Sensors Achievement Award, the Charles N. Reilley SEAC Electroanalytical Award and the Ralph Adams Pittcon Award in Bioanalytical Chemistry. He served as the Founding Chief Editor of the Wiley journal *Electroanalysis* and on the editorial board of 20 other journals. Wang is also a fellow of the RSC, ECS and AIMBE.

The research interests of Dr. Wang include bioelectronics and biosensors, wearable sensor systems, nanomotors and microrobots, and flexible materials. He has authored over 1200 research papers, 12 books, 55 patents, and 35 chapters (H Index 195). He was ranked as the most cited electrochemist in the systems biology. He has also worked as a professional engineer at NASA, where he contributed to the development of both aerospace and medical technologies.

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