האקדמיה הלאומית הישראלית למדעים
المجمع الوطني الإسرائيلي للعلوم والآداب
THE ISRAEL ACADEMY OF SCIENCES AND HUMANITIES

NATIONAL ACADEMY OF SCIENCES

The 3rd US–Israel Blavatnik Scientific Forum

Alleviating Global Water Scarcity by Desalination and Water Reuse

Program and Abstracts

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Menachem Elimelech, Yale University

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Washington, DC, September 10-11, 2024

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Program Day One / Tuesday, September 10

7:45 **Bus from the Fairmont Hotel to the NAS Building**

8:00 **Breakfast**

8:45 **Welcome Remarks**

Peter L. Thoren, Executive Vice President, Access Industries, Inc.

Menachem Elimelech, Yale University

Avner Adin, The Hebrew University of Jerusalem

9:00 **Keynote Speaker**

Meagan Mauter, Stanford University
Maximizing the Value of Water Infrastructure Investments for Humans and the Environment

10:00 *Session 1*

Seawater and Brackish Water Desalination

Chairs: **Moshe Herzberg, Amy Childress**

10:10 **Roy Bernstein,** Ben-Gurion University of the Negev
Polyelectrolyte-Based Membranes and Polymer Brush Modification for High Recovery Inland Desalination

10:40 **Shihong Lin,** Vanderbilt University
Leveraging the "Leakiness" of Nanofiltration to Enhance Water Recovery in Desalination

11:10 **Morning Break**

11:30 **Razi Epsztein,** Technion-Israel Institute of Technology
Targeting Solute-Solute Selectivity in Membrane-Based Desalination

12:00 **Pei Xu,** New Mexico State University
Development of Selective Electrodialysis for Separation of Mono- and Multi-Valent Ions During Water Reuse and Desalination

12:30 **Session 1 Discussion**

1:30 **Lunch**

2:30 *Session 2*

Management of Desalinated Water and Brine, and Wastewater Effluents

Chair: **Menachem Elimelech**

2:40 **Daniel Kurtzman,** The Volcani Institute
Storage and Remineralization of Desalinated Seawater in the Natural Subsurface

3:10 **Aaron Wilson,** Idaho National Lab
Solvent-Driven Mineral Recovery from Desalination Concentrates

3:40 **Baoxia Mi**, University of California, Berkeley
Interfacial Solar Evaporation for Brine Treatment

4:10 **Session 2 Discussion**

5:10 **Moshe Herzberg,** Ben-Gurion University of the Negev
Current Methods for Prediction of Reverse Osmosis Membrane Fouling and the Premise of Nano-Plasmonic Sensing

5:40 **Day 1 Adjourn**

5:45 **Reception**

6:15 **Dinner**

Program Day Two / Wednesday, September 11

7:30 **Bus from the Fairmont Georgetown to the NAS Building**

7:45 **Breakfast**

8:30 **Keynote Speaker**

Avner Adin, The Hebrew University of Jerusalem
Amalgamation of Water Treatment Research and Israel's Water Cycle

9:30 *Session 3*

Advanced Technologies for Water Reuse

Chairs: **Adi Radian, Ines Zucker**

9:40 **Tzahi Cath,** Colorado School of Mines
Three Years Experience with an Innovative, Versatile, Mobile Direct Potable Reuse Treatment System

10:10 **Adi Radian,** Technion-Israel Institute of Technology
Clay-Based Heterogeneous Fenton Catalysts for Removal and Destruction of PFAS and Other Organic Contaminants

10:40 **Morning Break**

10:50 **Megan Plumlee,** Orange County Water District
Water Agencies as Research Testbeds is Critical to Tackle Potable Reuse Challenges

11:20 **Ines Zucker,** Tel Aviv University
Selective Nanocomposites for Water Decontamination and Reuse

11:50 **Session 3 Discussion**

1:00 **Lunch**

2:00 *Session 4*

Environmental Impact and Societal Challenges of Desalination and Water Reuse

Chairs: **Sharon Walker, Avner Adin**

2:10 **Edo Bar-Zeev,** Ben-Gurion University of the Negev
Nexus of Seawater Desalination and the Aquatic Environment

2:40 **David Sedlak,** University of California, Berkeley
Navigating the Economic, Social and Environmental Challenges of Desalination and Water Reuse

3:10 **Afternoon Break**

3:20 **Osnat Gillor,** Ben-Gurion University of the Negev
The Fate of Pathogens, Antibiotics, and Resistance Genes in Treated Wastewater and the Irrigated Soils and Crops

3:50 **Amy Childress,** University of Southern California
Integrating Systems of Desalination and Potable Reuse for Flexible Water Supply

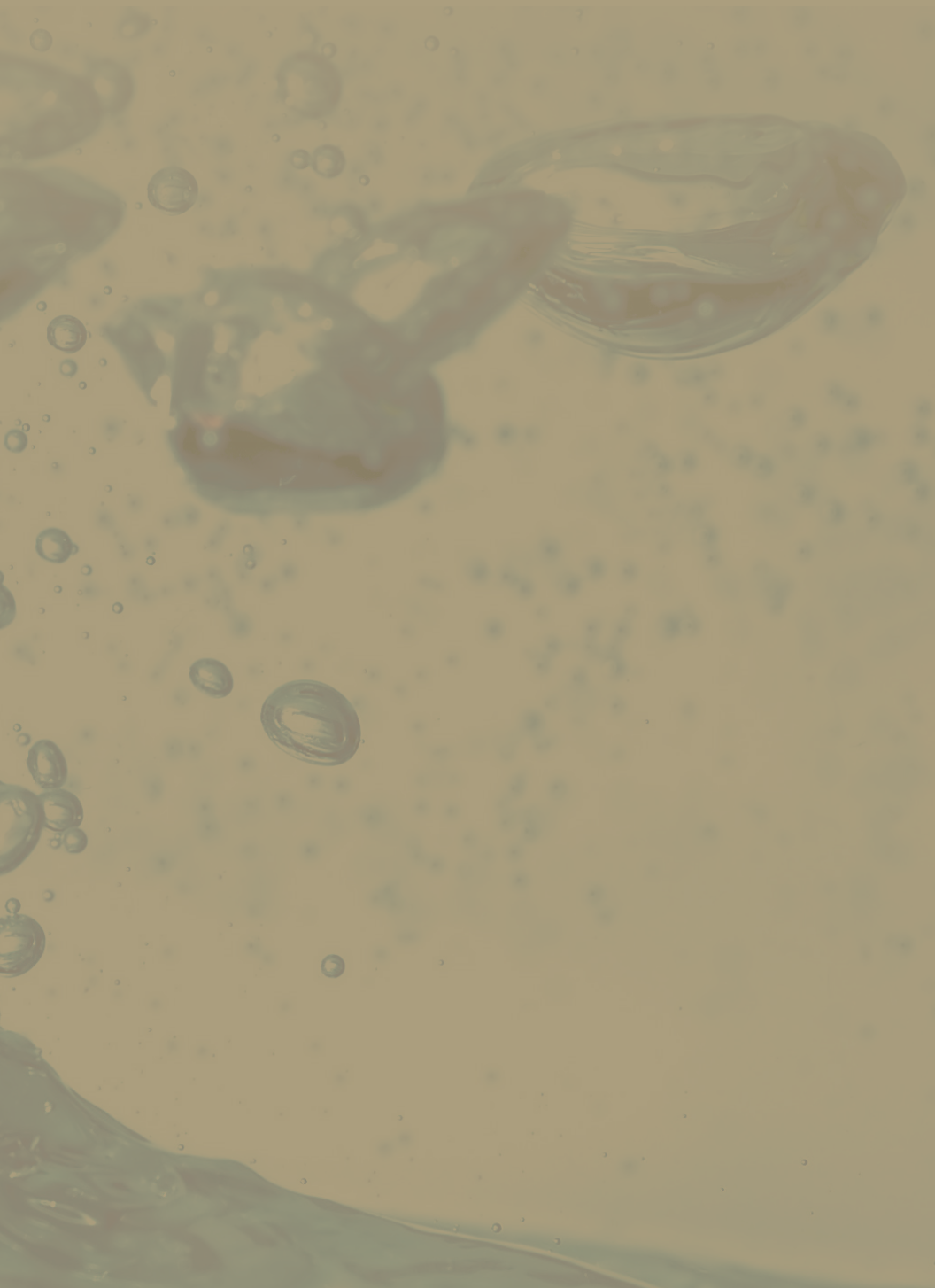
4:20 **Session 4 Discussion**

5:20 **Closing Remarks**

Menachem Elimelech, Yale University

Avner Adin, The Hebrew University of Jerusalem

5:30 **Forum Adjourn**



Abstracts

(in order of presentation)

Abstracts

Day One / Tuesday, September 10, 2024

Keynote Lecture

Maximizing the Value of Water Infrastructure Investments for Humans and the Environment

Meagan Mauter, Stanford University

Large scale infrastructure spending is necessary to repair aging water infrastructure and prepare water systems for future changes in supply and demand driven by climate change. But recent landmark spending bills in the United States represent only a fraction of the American Society of Civil Engineers estimated $2.5 trillion infrastructure investment deficit. How do we bridge this value gap? One answer is to "build back wiser" by investing dollars in digitized, versatile, distributed, and inclusive water infrastructure systems. This keynote lecture will highlight opportunities for wise infrastructure investments across water research space, provide specific examples relevant to Prof. Mauter's work in securing U.S. water supply through water reuse, and encourage attendees to critically position their work in the context of next generation water infrastructure systems. The strategies that researchers pursue for infrastructure redesign will determine service quality, equity, resiliency, cybersecurity, climate preparedness, and costs of water supply for generations.

Session I

Seawater and Brackish Water Desalination

Chairs:

Amy Childress, University of Southern California

Moshe Herzberg, Ben-Gurion University of the Negev

Polyelectrolyte-Based Membranes and Polymer Brush Modification for High Recovery Inland Desalination

Roy Bernstein, Ben-Gurion University of the Negev

A high recovery ratio in inland desalination is crucial but hindered by the high scaling of current polyamide membranes. We present two approaches to this challenge: 1. Developing mixed-charged polyelectrolyte membranes for high-recovery effluent desalination. 2. Grafting high-density polyzwitterion pseudo-bottle-brushes onto polyamide membranes to mitigate scaling in brackish water desalination.

Leveraging the "Leakiness" of Nanofiltration to Enhance Water Recovery in Desalination

Shihong Lin, Vanderbilt University

Reverse osmosis (RO) is the golden standard for seawater and brackish water desalination due to its superb energy efficiency and cost-effectiveness as compared to other desalination technologies. The water recoveries of current RO-based desalination processes have been optimized for energy consumption and cost. However, there are motivations to increase water recovery of existing desalination plants from either the increasing concern of brine discharge or the need to enhance water production capacity of existing plants for drought adaptation. Nanofiltration (NF) is a process that has recently received increasing

attention for treating RO brine due to its "leakiness" that enables concentrating a solution to an osmotic pressure that far exceeds the applied pressure. Here, I will share our recent progress in understanding how an NF membrane behave at high and changing salinity and how we can leverage its self-regulating membrane properties to develop integrated RO/NF process for enhanced water recovery.

Targeting Solute-Solute Selectivity in Membrane-Based Desalination

Razi Epsztein, Technion – Israel Institute of Technology

While membrane-based desalination processes primarily rely on an adequate separation between water and solutes, upgrading these processes to obtain selectivity between different solutes can be highly advantageous in certain cases. In this talk, I will discuss opportunities and attempts to achieve selectivity between solutes in membrane-based desalination processes using improved process engineering and membrane design. Our recent fundamental insights into the selectivity mechanisms in desalination membranes will also be discussed.

Development of Selective Electrodialysis for Separation of Mono- and Multi-Valent Ions During Water Reuse and Desalination

Pei Xu, New Mexico State University

Selective separation of mono- and multi-valent ions has important applications for water reuse and desalination. Monovalent permselective ion-exchange membranes were developed by modifying normal-grade membranes with conductive polymers and nanomaterials. Bench- and pilot-scale electrodialysis experiments were conducted to investigate desalination performance and economic benefits for treating municipal wastewater, brackish water, and concentrate.

Session II

Management of Desalinated Water and Brine, and Wastewater Effluents

Chair:

Menachem Elimelech, Yale University

Storage and Remineralization of Desalinated Seawater in the Natural Subsurface

Daniel Kurtzman, The Volcani Institute

Managed Aquifer Recharge (MAR) with water of different sources and qualities is a worldwide growing practice that uses the subsurface for cheap storage and water treatment. Generally, in Israel, the large MAR operations are divided to irrigation-water supply system fed by secondary effluents (Shafdan) and potable-water supply systems fed by winter ephemeral storm flows and excess of desalinated seawater (DSW, 0.5-3% of production). The Menashe Streams MAR system recharges storm flows since 1968 and DSW since 2014. Observations and models of infiltration-recharge dynamics of DSW at the Menashe site show that surface-clogging can be neglected and the low permeability lenses in the variably saturated zone control infiltration and recharge rates. The very high Ca/Mg ratio in the DSW product drives cation exchange in the porous medium, which enriches the percolating DSW by 2-3 mg/l of Mg in the short downward journey to the water-table (days). In the aquifer (years) both mixing with ambient groundwater and additional rock-water reactions further enrich the recovered water with magnesium. Simulations of recharge with non-CaCO3-post-treated DSW show that Ca enrichment to the level achieved by the industrialized process will be done naturally in the sub surface at a lower cost (environmentally and economically), the Mg enrichment, describe before, will be the same (calcite dissolution will increase the Ca/Mg ratio that will lead to similar cation exchange). Uncertainty concerning mixing of storm water

and DSW in the aquifer is dealt with flow and conservative-transport model realizations combined with observations of heavy-isotopes of water (very good tracers of reverse-osmosis DSW). Reactive transport model results in the aquifer (work in progress) will be shown as well. The subsurface as a source of Ca and a Ca/Mg ion-exchanger shown for MAR with DSW will be discussed also for the Shafdan MAR system fed by secondary effluents. The Shafdan operation is much more intensive and steady, and data from the "Sea-of-Galilee Era" and the "DSW Era" show that in both eras the subsurface added Ca to the recovered water whereas it adsorbed Mg in the first, and desorbes it in the current DSW era.

Solvent-Driven Mineral Recovery from Desalination Concentrates

Aaron Wilson, Idaho National Lab

The cost of seawater desalination has been approaching a thermodynamic and economic minimum. Future reductions are expected to be modest in both categories. Incorporation of mineral recovery into desalination is a reasonable step to transition desalination from an infrastructure cost to a revenue generating industry. Mineral resources are evaluated on mineral value and ore grade (mineral concentration). In the case of seawater there is 1 Kg of magnesium (Mg) for every m3 of seawater valued at 2 to 7 USD/Kg Mg. Solvent-driven salt solubility depression, specifically dimethyl ether fraction crystallization (DME-FC), can recover Mg salts (and other mineral salts) as dry solids directly from seawater concentrates far from a mineral salt's saturation point. DME-FC can achieve mineral salt recoveries of greater than 98% relative to saturation with selectivities greater than 700. Selectively isolating solids without evaporative or membrane-based concentration changes how many process streams and effluents can be managed, with implications on mining, industrial wastewater, and seawater desalination.

Interfacial Solar Evaporation for Brine Treatment

Baoxia Mi, University of California, Berkeley

Interfacial solar evaporation is presented as an emerging technology for brine management. We will discuss technological development, photothermal materials, fundamental aspects of interfacial evaporation, and key issues to be addressed. The importance of structural design will be illustrated by presenting our recent work on 3D-graphene oxide stalk as solar evaporator.

Current Methods for Prediction of Reverse Osmosis Membrane Fouling and the Premise of Nano-Plasmonic Sensing

Moshe Herzberg, Ben-Gurion University of the Negev

Lately, the prediction of both UF and RO membrane fouling was carried out in our lab, taking advantage of new phenomenon to the field of membrane research: The localized surface plasmon resonance (LSPR) sensing. LSPR generation occurs due to the interaction between incident light (visible range for noble metals) and discrete metallic nanostructures, causing electrons in the metal conduction band to oscillate, and the electromagnetic field near a nanostructure's surface to become amplified. Within the vicinity of locally enhanced field, small changes in the local dielectric environment, caused by adsorption of molecules, are manifested as changes in the intensity of scattered and/or absorbed light at different wavelengths. The high sensitivity of LSPR towards adsorbed material, up to tens of nm from the surface, offers a precise prediction of membrane's initial fouling scenarios. For the first time, we imply LSPR technology for indication of model and environmental foulants accumulation on RO and UF membrane surfaces, eventually predicting their effect on the membrane performance. The real-time LSPR sensing of membrane fouling provides immediate information that can potentially minimize failures of energy intensive large-scale water and wastewater treatment and desalination facilities.

Day Two / Wednesday, September 11, 2024

Keynote Lecture

Amalgamation of Water Treatment Research and Israel's Water Cycle

Avner Adin, The Hebrew University of Jerusalem

Water treatment research in Israel is mostly driven by necessity. Its overview vis-à-vis the country's water cycle is presented, highlighting desalination and water reuse as water resources. Listing the research incentives is followed by introducing the research institutions, pointing at research financing sources and sampling some scientific works and innovations.

Session III

Advanced Technologies for Water Reuse

Chairs:

Adi Radian, Technion-Israel Institute of Technology

Ines Zucker, Tel Aviv University

Three Years Experience with an Innovative, Versatile, Mobile Direct Potable Reuse Treatment System

Tzahi Cath, Colorado School of Mines

In recent years, we have witnessed large cities running out of water supplies, highlighting the need for balanced resource portfolios to ensure uninterrupted supply of water. To demonstrate that DPR is a viable option, we have designed and constructed a fully automated/autonomous mobile demonstration lab that explores and enhances a train of advanced water treatment technologies while demonstrating to the public that DPR is a safe solution.

Clay-Based Heterogeneous Fenton Catalysts for Removal and Destruction of PFAS and Other Organic Contaminants

Adi Radian, Technion-Israel Institute of Technology

Advanced reduction and oxidation processes are the leading technology for the removal and destruction of highly recalcitrant organic pollutants such as high MW PAHs, per-fluorinated (PFAS) compounds and more. In our lab we are working on designing clay-based materials to serve as low-cost, yet effective sorbent-catalysts. Specifically, montmorillonite clay decorated with nano-sized iron oxides through a simple wet deposition method, is applied as a heterogenous Fenton catalyst. The resulting material, FeOx-MMT, exhibits very high catalytic reactivity in systems with diverse oxidants, such as persulfate, peroxide and mixed oxidant systems, and can out-preform other widely used iron-oxides. The high reactivity and effective degradation of pollutants was most pronounced in the hydrogen peroxide system, where the model pollutant phenanthrene was completely mineralized within 90 min of reaction. The amorphous iron-clay was also tested in several other systems, where an adsorptive polymer was added to the material to attract the compounds to the surface. This resulted in exceptional removal and mineralization of several PFAS chemicals, pharmaceuticals, industrial additives, and polyphenols. The underlying mechanisms were studied using chemical probes and EPR measurements. The results revealed a high complexity regarding the type and concentration of radicals formed – for aromatic compounds, hydroxyl radicals were formed alongside singlet oxygen and superoxide species, whereas for the aliphatic PFAS systems, only hydroxyl radicals were identified. The synthesis of this reactive material is simple yet effective, and could help reach the water quality needed to meet the new legislative goals regarding wastewater and drinking water quality.

Water Agencies as Research Testbeds is Critical to Tackle Potable Reuse Challenges

Megan Plumlee, Orange County Water District

Diverse sources of technological innovation benefit water reuse globally and include academic research, industry (e.g., start-ups), and water agencies. This presentation will summarize current challenges facing the Orange County Water District, which operates a large, membrane-based potable reuse plant, and will highlight a few technologies being tested. It is critical that ideas for innovation be tested in real water facilities via cross-cutting collaborations to tackle current challenges and improve the economics and feasibility of reuse.

Selective Nanocomposites for Water Decontamination and Reuse

Ines Zucker, Tel Aviv University

Contamination of water and wastewater by a variety of chemicals demands more efficacious and reliable treatment technologies. Nanotechnology-based approaches have been increasingly explored to enhance or replace traditional remediation methods because of the high reactivity and tunable-properties of nanomaterials. Dr. Zucker will provide an overview on engineered and bio-based composites developed for multifunctional removal of organic and inorganic pollutants. Material properties, removal mechanisms, and barriers for implementation will be extensively discussed.

Session IV

Environmental Impact and Societal Challenges of Desalination and Water Reuse

Chairs:

Avner Adin, The Hebrew University of Jerusalem

Sharon Walker, Drexel University

Nexus of Seawater Desalination and the Aquatic Environment

Edo Bar-Zeev, Ben-Gurion University of the Negev

Seawater desalination has a tight nexus with the environment: from the impact of feedwater quality on process efficiency to the footprint of discharged brine on marine ecosystems. Changes in seawater quality due to sewage outbursts, jellyfish swarms and oil spills can critically impair freshwater production. These organic contaminants pass the pretreatment stages and enhance transmembrane pressure by more than 20% after 3-6 days. Minimizing the impact of organic outbursts on freshwater production calls for the application of alternative procedures or the development of new barriers. Inversely, this industry can impact the aquatic environment by discharging brine waste. Dense brine often sinks and flows over the bottom, thus affecting nutrient fluxes, while critically altering the physiology of various keystone organisms such as seagrass, corals, and bacteria. Future efforts should focus on the development and operation of viable technologies that minimize the volumes of brine discharged into the environment.

Navigating the Economic, Social and Environmental Challenges of Desalination and Water Reuse

David Sedlak, University of California, Berkeley

To gain insight into the future for desalination and water reuse and to identify future research needs it is worthwhile to consider current trends in California—the US state that tends to be on the leading edge of water infrastructure innovation and investment. For seawater desalination, decreases in the cost did not lead to a boom in the construction of large facilities, in part due to a failure of proponents to establish social legitimacy. Instead, smaller plants that desalinate brackish groundwater and surface water proliferated. In coming decades, small-scale brackish groundwater desalination could expand further in the state's inland valleys provided that the unfavorable economics of brine management can be resolved. For water reuse, construction of centralized, non-potable treatment systems has slowed as social acceptance and institutional reforms have supported efforts to recycle nearly all of California's sewage by 2040. The next opportunities for water reuse may involve premise-scale water recycling systems enabled by autonomous system control and electrification of treatment processes. Lessons learned in California are particularly relevant in the American West, Mediterranean Europe, and other wealthy, increasingly water scarce regions.

The Fate of Pathogens, Antibiotics, and Resistance Genes in Treated Wastewater and the Irrigated Soils and Crops

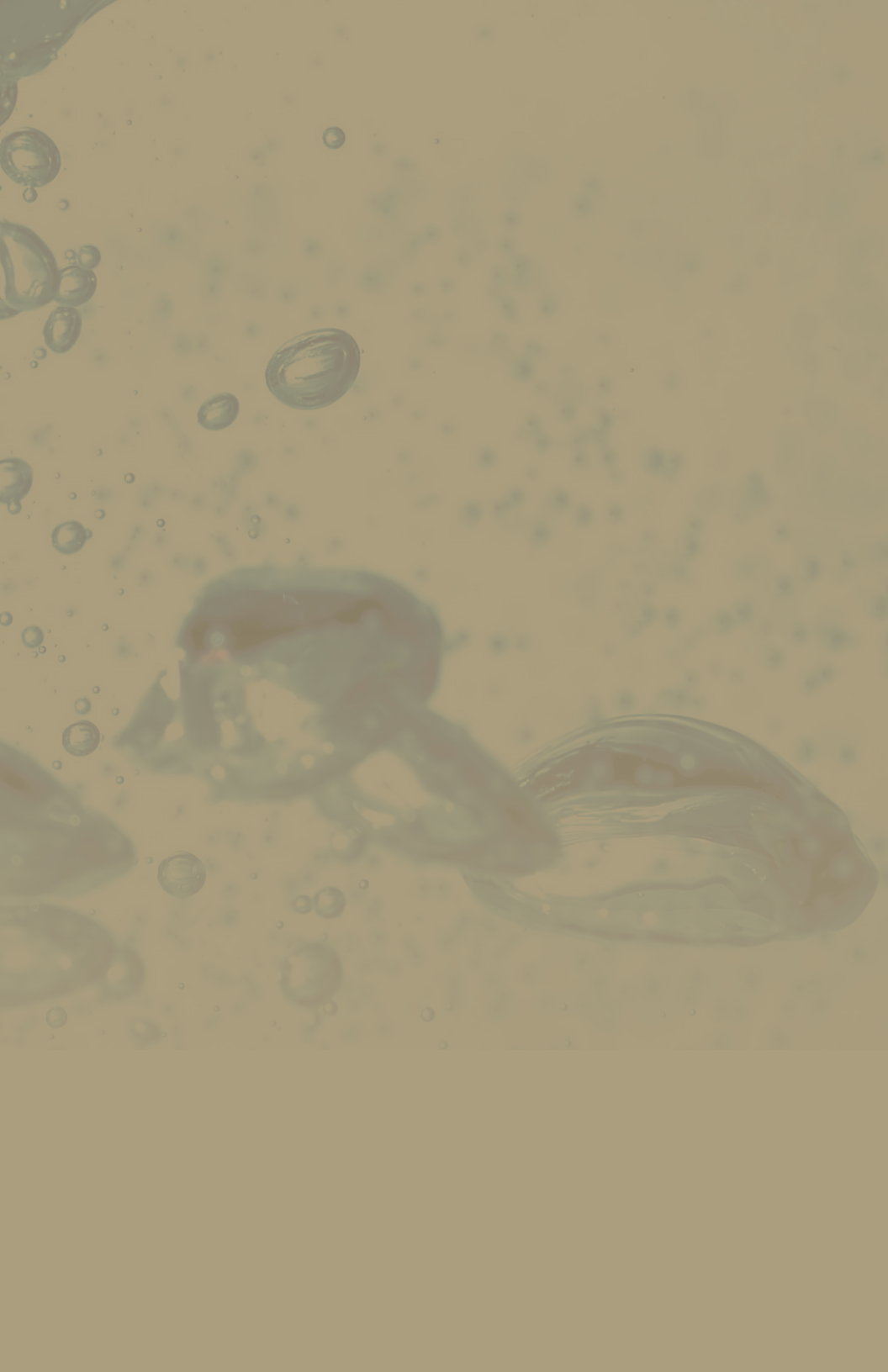
Osnat Gillor, Ben-Gurion University of the Negev

TWW irrigation could present a considerable health risk, especially for freshly eaten produce. We challenge the restrictions imposed on the use of TWW for irrigation and hypothesize that soil presents a barrier to TWW associated pathogens, antibiotics, and resistance genes en route to the crops. Our results indicate that although TWW are rich in contaminants it does not necessarily endanger the crops. Our results demonstrate the importance of soil health to sustainable agricultural practices.

Integrating Systems of Desalination and Potable Reuse for Flexible Water Supply

Amy Childress, University of Southern California

This talk summarizes a series of papers that conceptually analyze synergistic configurations of potable reuse and desalination. Blending scenarios that make the highest use of the water resource while minimizing energy and environmental impacts will be introduced. Case studies and future schemes for augmented water systems will be discussed. By sharing/integrating process streams and infrastructure, some challenges and constraints of meeting water supply demand can be overcome.



Biographies

(In alphabetical order)

Biographies

Avner Adin
The Hebrew University of Jerusalem

Professor Avner Adin is the Lunenfeld-Kunin Professor Emeritus of Environmental Sciences at the Hebrew University of Jerusalem, leading Water Treatment and Technology. Research areas: Filtration, particle characterization, electroflocculation, membrane fouling and bio-nano-particles interactions. He is Chairman of Israel Institute of Standards' Central Water Committee after serving as Israel's national Drinking Water Quality Standards Committee Chairman. Member of American Academy of Environmental Engineering. Prof. Adin received several awards, among them AWWA Best Publication Award, Hokkaido University Environmental Engineering Award, Hebrew University Innovation Award, and Life Achievements Awards from ANEAS and Minister of Environment, Mexico and Israeli Water Association. Prof. Adin is the Founder and Past-President of Israeli Water Association and a founding member of IWA's Specialist Group on Particle Separation where he also served as Committee Member for many years. Adin is serving as Guest Editor at Energies journal. He authored hundreds of scientific and technical articles and many engineering solutions reports.

Pedro Alvarez
Rice University

Pedro J. Alvarez is the George R. Brown Professor of Civil and Environmental Engineering at Rice University, where he also serves as Director of the NSF Engineering Research Center on Nanotechnology-Enabled

Water Treatment (NEWT). His research interests include environmental nanotechnology, bioremediation, fate and transport of toxic chemicals, water footprint of biofuels, water treatment and reuse, and antibiotic resistance control. Alvarez received the B. Eng. Degree in Civil Engineering from McGill University and MS and Ph.D. degrees in Environmental Engineering from the University of Michigan. He is the 2012 Clarke Prize laureate for outstanding research in water science and technology. Alvarez is an Executive Editor of ES&T, and previously served on the scientific advisory board of the EPA and of the advisory committee of the NSF Engineering Directorate. He was elected to the National Academy of Engineering for outstanding contributions to the practice and pedagogy of bioremediation and environmental nanotechnology.

Edo Bar-Zeev

Ben-Gurion University of the Negev

Prof. Edo Bar-Zeev joined the Zukerberg Institute for Water Research, at the Jacob Blaustein Institutes for Desert Research, Sde Boker Campus as an applied and environmental microbiologist after completing a Post-Doc at Yale University, USA. His research interests focus on "Microbes in aquatic systems": from nexus between the desalination or water treatment industry and the aquatic environment to nitrogen cycling in marine and freshwater environments. For example, Edo is leading a wide group of scientists that investigate the various effects of large-scale desalination facilities on the Gulf of Aqaba's coastal ecosystem, including coral reefs, sea-grass meadows, and sub-surface bacteria. In addition, his students are studying different ways to minimize the nexus between these industries and the aquatic environment. Concurrently, Edo is also heading a global project that focuses on the contribution of microbes, termed diazotrophs, to aquatic nitrogen cycle via microbial dinitrogen fixation. Specifically, his group has developed

a unique sampling kit for freshwater that was shipped to 85 researchers from 42 countries across the globe. Once shipped back to BGU, these samples are analyzed using state-of-the-art biochemical and molecular methods that were developed by Edo's group to count and identify these unique microbes. The outcomes of this endeavor will shed new light on the contribution of these diazotrophs to the nitrogen cycle and the "ecological health" across the global freshwater ecospace.

Roy Bernstein

Ben-Gurion University of the Negev

Roy Bernstein received his BSc in Chemistry and Environmental Science and MSc in Soil and Water Sciences, both from the Hebrew University. He completed his Ph.D. at the Department of Environmental Engineering and The Zuckerberg Institute for Water Treatment at Ben-Gurion University of the Negev. After conducting post-doctoral studies at Essen University in Germany and KULeuven in Belgium, he returned to The Zuckerberg Institute for Water Treatment to establish his laboratory. His laboratory focuses on advancing material and polymer science in membrane science and technology, aiming to develop and improve membranes with specific properties for environmental and industrial applications, particularly in water and wastewater treatment and desalination. The research conducted in the lab combines fundamental studies on model systems with well-defined characteristics, as well as laboratory- and pilot-scale investigations using real solutions to investigate membrane properties and optimize their performance for practical applications.

Tzahi Cath
Colorado School of Mines

Dr. Tzahi Cath is a professor of environmental engineering at the Colorado School of Mines. His research focuses on membrane separation processes for desalination and water reclamation, on desalination of concentrated brines for water and mineral recovery, potable reuse of reclaimed water, treatment of industrial wastewater (especially in the oil and gas upstream sector), and on the interface between energy and water. Prof. Cath research also involves data science and renewable energy integration into water and wastewater treatment systems. Prof. Cath is the Co-Director of the Center for a Sustainable WE2ST at Mines, and he holds a joint appointment with the National Renewable Energy Laboratory (NREL).

Amy Childress
University of Southern California

Dr. Amy Childress is Professor of Civil and Environmental Engineering and Director of the Environmental Engineering Program at the University of Southern California. Her research team seeks holistic and realistic solutions to the problem of finite water and energy resources. Her team carries out projects on innovative solutions to contaminant and energy challenges including: pressuredriven membrane processes as industry standards, innovative membrane materials and processes, systems of desalination and wastewater reclamation, and colloidal and interfacial aspects of physicochemical processes. Dr. Childress serves on US EPA's Science Advisory Board, as an editor of Desalination, and on expert advisory panels for regional and international desalination and wastewater reclamation projects.

Gedeon Dagan
Tel Aviv University

Gedeon Dagan is a Professor Emeritus at the Faculty of Engineering, Tel Aviv University and an elected member of the Israel Academy of Sciences. His broad field of research is Hydrology, focused on groundwater and more specifically on development of models of water flow and contaminant transport in the subsurface. Professor Dagan is considered as the founder of a new discipline, stochastic modeling of flow and transport. His monograph "Flow and Transport in Porous Formations" (Springer Verlag, 1989) is widely used and cited. Professor Dagan's contributions were acknowledged by a few awards, the most notable being: Fellowship and Horton Medal of the American Geophysical Union, Doctor Honoris Causa of three universities, the Stockhom Water Prize and the Israel Prize.

Menachem Elimelech
Yale University

Menachem Elimelech is the Sterling Professor of Chemical and Environmental Engineering at Yale University. His research focuses on membrane-based technologies at the water-energy nexus, materials for next-generation desalination and water purification membranes, and environmental applications of nanomaterials. Professor Elimelech was the recipient of numerous awards in recognition of his research contributions. Notable among these awards are the 2005 Clarke Prize for excellence in water research; election to the US National Academy of Engineering in 2006; Eni Award for 'Protection of the Environment' in 2015; and election to the Chinese Academy of Engineering in 2017, the Australian Academy of Technology and Engineering in 2021, and the Canadian Academy of Engineering in

2022. Professor Elimelech has advised 49 PhD students and 44 postdoctoral researchers, many of whom hold leading positions in academia and industry.

Razi Epsztein
Technion-Israel Institute of Technology

Razi Epsztein is an Assistant Professor in the Faculty of Civil and Environmental Engineering at the Technion – Israel Institute of Technology. He received his BSc and MSc degrees from Ben-Gurion University of the Negev (Israel), PhD from the Technion – Israel Institute of Technology, and postdoctoral training in the lab of Prof. Menachem Elimelech at Yale University. His main research interests center on membrane-based processes for water and wastewater treatment, with current research activities focusing on understanding the mechanisms of molecular transport and selectivity in membranes and nanopores.

Osnat Gillor
Ben-Gurion University of the Negev

Osnat Gillor is a Professor at the Zuckerberg Institute for Water Research at Ben-Gurion University of the Negev. Her research focuses on microbial aspects of soil dynamics in arid environments. She is particularly interested in understanding the role of perturbations like rain, irrigation, pollution, or mining on the soil microbial community composition, structure, and function. Recently, her group is focusing on the effects of various contaminants carried by municipal treated wastewater to trophic interactions in the irrigated soil microbial communities.

Moshe Herzberg
Ben-Gurion University of the Negev

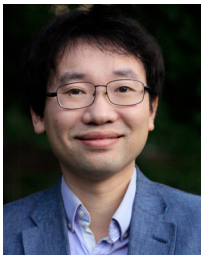
Moshe Herzberg is the head of the desalination and water treatment department at the Zuckerberg Institute for Water Research (ZIWR) at Ben-Gurion University of the Negev (BGU) in Israel. He is a full Professor at BGU, originally appointed as a faculty member in 2007. Prof. Herzberg did his postdoctoral training at Yale University and received both a PhD in Agricultural Engineering and a BSc in Chemical Engineering from the Technion, the Israel Institute of Technology in Israel.

Prof. Herzberg's research interests focus on microbial biofilms, biofouling and fouling of membranes, interfacial processes that relate to membrane separation and "anti-fouling" modified-surface membranes. Prof. Herzberg is an author of 90 scientific publications and more than 140 presentations and seminars presented all over the world. He serves as a co-leader of the CoWERC, The US-Israel Collaborative Water-Energy Research Center. Prof. Herzberg is currently performing an enhanced synergistic collaboration with different scientists and industries around the globe, from the Palestinian Authority, Jordan, Germany, the United States and Israel.

Daniel Kurtzman
The Volcani Institute

Dr. Daniel (Dani) Kurtzman received 1-3rd degrees in Atmospheric, Environmental, and Soil&Water Sciences from the Hebrew University of Jerusalem (1991-2005). Starting in his Master thesis (1996), his focus is subsurface

hydrology. He had his Post-Doctorate at the University of Texas – Austin (2005-2007). Since 2008 he is a researcher at the Israeli governmental Agricultural Research Organization – The Volcani Institute. Dani's main expertise are: Managed Aquifer Recharge (desalinated seawater, infiltration basins, dry wells); Nitrate contamination of groundwater under agricultural land; Soil-Aquifer phenomenon under Vertisols and Water Resources of Israel (which he teaches at the Faculty of Agriculture, Hebrew U). Field surveys and monitoring of the deep unsaturated zone, controlled lysimeters experiments, groundwater field hydrology and geochemistry, unsaturated and saturated flow and transport modelling are the major methodologies used in his research group. To the beginning of 2023 Dani authored\co-authored 43 international peer-reviewed papers as well as some book chapters and local papers.



Shihong Lin
Vanderbilt University

Dr. Shihong Lin is an Associate Professor in the Department of Civil and Environmental Engineering and the Department of Chemical and Biomolecular Engineering at Vanderbilt University. There, he directs a research group with a mission to advance aqueous separation processes to address critical challenges for sustainability the water-energy-food nexus. Dr. Lin has received numerous recognitions, including the Excellence in Graduate Mentoring Award from Vanderbilt (2023), the Walter Huber Prize from the American Society of Civil Engineers (2023), Highly Cited Researcher from Clarivate (2022), Paul L Busch Award from Water Research Foundation (2020), and the Young Investigator Award from CAPEES (2020). Dr. Lin is the current president of the association of Chinese American Professors in Environmental Engineering and Science (CAPEES) and holds editorial roles in multiple respected journals.

Meagan Mauter
Stanford University

Professor Meagan Mauter is an Associate Professor of Civil & Environmental Engineering and Global Environmental Policy at Stanford University and Senior Fellow in the Precourt Energy Institute and Woods Institute for the Environment. She directs the Water & Energy Efficiency for the Environment Lab (WE3Lab) with the mission of providing sustainable water supply in a carbon-constrained world. Ongoing research efforts include: 1) developing desalination technologies to support a circular water economy, 2) coordinating operation of decarbonized water and energy systems, and 3) supporting the design and enforcement of water-energy policies.
Professor Mauter also serves as the research director for the National Alliance for Water Innovation, a $110-million DOE Hub addressing U.S. water security issues. The Hub targets early-stage research and development of energyefficient and cost-competitive technologies for distributed desalination of non-traditional source waters.

Professor Mauter holds bachelors degrees in Civil & Environmental Engineering and History from Rice University and a PhD in Chemical & Environmental Engineering from Yale University. Prior to joining the faculty at Stanford, she served as an Energy Technology Innovation Policy Fellow at the Belfer Center for Science and International Affairs, Visiting Scholar at the Mossavar Rahmani Center for Business and Government at the Harvard Kennedy School of Government, and Associate Professor at Carnegie Mellon University.

Baoxia Mi

University of California, Berkeley

Prof. Baoxia Mi is the Wood Calvert Chair of Engineering and an Associate Professor in the Civil and Environmental Engineering Department at the University of California, Berkeley. She received BS and MS from Tianjin University in China, Ph.D. from the University of Illinois at Urbana-Champaign, and a postdoctoral training at Yale University. She directs the research and educational activities of the Membrane Innovation Lab, studying physicochemical and biological processes with emphasis on advanced membrane processes and nanotechnology. Dr. Mi's achievements include an NSF CAREER Award, Hellman Fellows Award, CAPEES/Nanova Young Investigator Award, and Bakar Spark Prize.

Yoram Oren

Ben-Gurion University of the Negev

Yoram Oren is an Emeritus Professor of the Zuckerberg Institute for Water Research (ZIWR) at the Ben-Gurion University of the Negev. He joined the Department for Desalination and Water Treatment, ZIWR, in May 2002 after 34 years of service with the Israel Atomic Energy Commission. He completed his PhD studies at the Weizmann Institute of Science. His research interests cover the fields of reverse osmosis, nanofiltration, ultrafiltration for desalination and water treatment, electrochemical processes for water treatment, surface phenomena, electrodialysis for water treatment and desalination, ion exchange membranes, electrochemical phenomena in pressure driven processes for water treatment, capacitive deionization, electrochemical aspects in biofouling of membranes for water treatment, Donnan exchange processes for water decontamination.

Megan Plumlee

Orange County Water District

Megan Plumlee, Ph.D., P.E. is the Director of Research for the Orange County Water District (OCWD) in Fountain Valley, California, where she oversees a team of research scientists and engineers conducting applied studies to support the District's core operational needs. This includes evaluations of promising new technologies for the advanced purification process for potable reuse as well as for groundwater recharge. Megan has authored or co-authored over 30 peer-reviewed publications in scientific journals. Her current work includes oversight of OCWD's PFAS pilot study, which is testing various treatment options for removing PFAS from groundwater.

Adi Radian

Technion-Israel Institute of Technology

Dr. Adi Radian is an Associate Prof. at the Faculty of Civil and Environmental Engineering at the Technion in Haifa, Israel. Adi completed her PhD at the Faculty of Agriculture of the Hebrew University, in Soil and Water Sciences and carried out her post-doctoral fellowship at the Biotechnology institute of the University of Minnesota. In the fall of 2016, she opened the Environmental Soil Chemistry Lab which is focused on unraveling the complex processes that govern the fate of pollutants in the environment, and on the development of novel water and soil remediation technologies. The work is centered around coupling adsorption with biogeochemical degradation processes to improve and design new treatment strategies. The research in the lab also explores basic chemical and biological processes at the water/soil interface; colloidal interactions with organic macromolecules; and surface transformation reactions of pollutants by clays and oxides.

David Sedlak
University of California, Berkeley

David Sedlak is the Plato Malozemoff Distinguished Professor in the Department of Civil & Environmental Engineering and the Director of the Berkeley Water Center at the University of California at Berkeley. Dr. Sedlak is a member of the US National Academy of Engineering, chair of its Water Science & Technology Board and recipient of numerous awards. He is also the author of "Water for All: Global Solutions for a Changing Climate"(Yale University Press 2023). Dr. Sedlak serves as the "Master Cartographer" for the National Alliance for Water Innovation (NAWI), a multi-year research effort of the US Department of Energy, where he directs efforts to create research roadmaps for advancing desalination and advanced water treatment in the municipal, industrial and agricultural sectors in the United States.

Sharon Walker
Drexel Engineering

Sharon L. Walker, PhD, is Dean of Drexel Engineering and Distinguished Professor of Civil, Architectural and Environmental Engineering, as well as Executive Director of ELATES at Drexel, a national leadership development program committed to increasing the representation of women in STEM. She is principal investigator on the NSF Advance Grant, "Catalyzing STEM Gender Equity at Drexel: Building a Foundation for Systemic Transformation," and in 2021 received the Winifred Burks-Houck Professional Leadership Award from the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers. A Yale University-trained water quality systems expert focusing on the fate and

transport of bacteria and nanoparticles in water, Walker is a fellow of AEESP, AAAS, and AIMBE. Walker has produced more than 250 conference papers and publications, and in 2018 won the AEESP inaugural Mary Ann Liebert Award for Publication Excellence in Environmental Engineering Science. She holds a PhD in Environmental Engineering and an MS in Chemical Engineering, both from Yale, and earned two undergraduate engineering degrees in environmental engineering and environmental studies from the University of Southern California.

Aaron Wilson

Idaho National Lab

Dr. Aaron D. Wilson is a research chemist with over 20 years of experience in industry, academics, and government laboratories. As a Ph.D. student at the University of Colorado Boulder, he worked in collaboration with researchers at the National Renewable Energy Laboratory and Pacific Northwest National Laboratory on the thermodynamics of homogeneous electrocatalysts. He went on to complete postdoctoral appointments at California Institute of Technology and the National Institutes of Health. As of 2023, Wilson's work is documented in 38 peerreviewed journal articles and chapters. He has been awarded 6 patents and has 6 active patent applications. Since arriving at INL in 2010, he has been an active principal investigator and is the current Chemical Separations Group Lead. His work ranges from fundamental solution theory to the design of pilot water treatment systems. He has pioneered the use of solvents and phase-change materials for water treatment and other separations. This work has resulted in multiple recognitions, including two R&D 100 awards and a technology demonstration at the White House in 2016.

Pei Xu
New Mexico State University

Pei Xu is a professor in the Department of Civil Engineering at New Mexico State University, and the research director of the New Mexico Produced Water Research Consortium. She leads basic and applied research on water quality, water reuse, desalination, and resource recovery. The goal of her research is to address critical water challenges in arid and semi-arid regions using non-traditional water supplies to enhance water sustainability and resilience. She was selected as a Leshner Fellow on Food and Water Security by the American Association for the Advancement of Science (AAAS); PESCO Endowed Professorship and C. Herb Ward Family Endowed Interdisciplinary Chair at NMSU.

Ines Zucker
Tel Aviv University

Dr. Ines Zucker holds a B.Sc. degree in Mechanical Engineering, M.Sc. degree in Materials and Nanotechnologies Engineering, and Ph.D. in Materials Science and Engineering with expertise Environmental Engineering, all from Tel Aviv University. Alongside these diverse educational experiences, Ines completed her postdoctoral training at Yale University at the field of environmental applications and implications of nanotechnology. In her faculty appointment, Ines now serves as a jointly-appointed senior lecturer in the School of Mechanical Engineering and Porter School of Environmental Studies. Using a wide skill-set combining material sciences and environmental engineering, the ZuckerLab focuses on advanced materials and novel approaches for environmental applications, alongside with environmental and health impacts of nanotechnology.

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