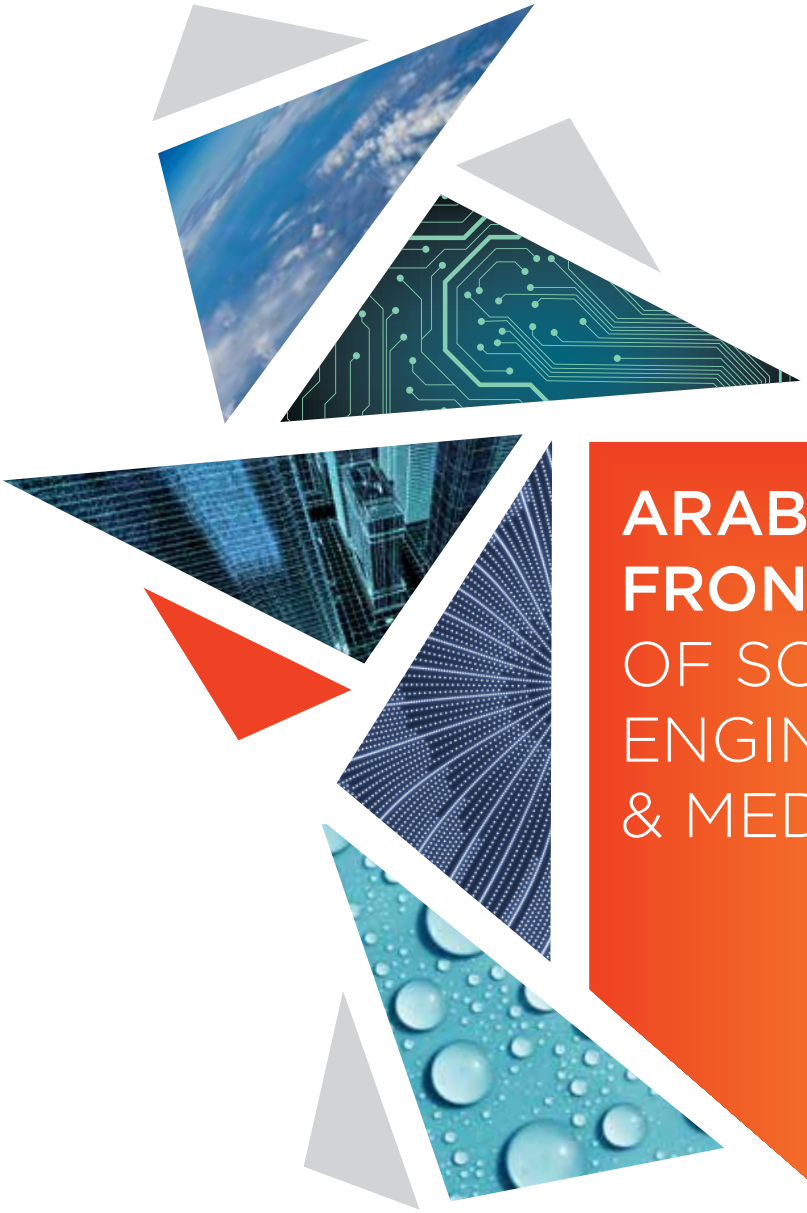
KFAS
مؤسسة الكويت للتقدم العلمي
Kuwait Foundation for the Advancement of Sciences

The National Academies of SCIENCES ENGINEERING MEDICINE



ARAB - AMERICAN FRONTIERS OF SCIENCE, ENGINEERING, & MEDICINE

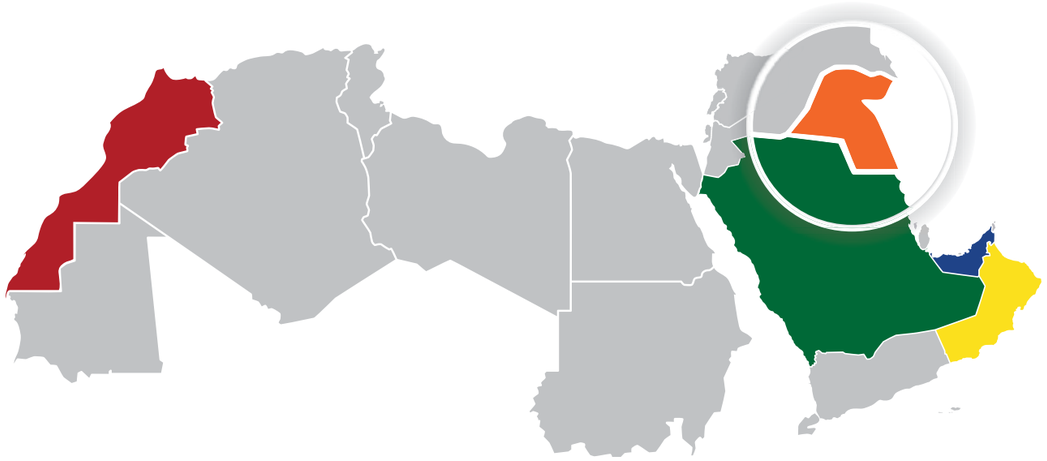
Sixth Symposium
November 4-6, 2018, Kuwait

NSF

USAID FROM THE AMERICAN PEOPLE

NASA

Symposium Editions



Kuwait Foundation for The Advancement of Sciences, 2018
Kuwait City, Kuwait

108 Participants from 13 Countries
34% women
Sessions: Big Data, Water Systems, The Microbiome, Air Quality, Next Generation Buildings and Infrastructure

Kuwait Institute for Scientific Research 2011
Kuwait City, Kuwait

107 Participants from 18 Countries
35% women
Agriculture, Water, Renewable Energy, Diabetes

The Research Council and Sultan Qaboos University, 2014
Muscat Oman

118 Participants from 16 Countries
30% women
Water Reuse, Hydraulic Fracturing, Food Security, Cancer

King Abdullah University of Science and Technology, 2015
Thuwal, Saudi Arabia

101 Participants from 11 Countries
27% women
Sensing Technologies, Networks and Applications

Masdar Institute, Khalifa University, NYU Abu Dhabi and Petroleum Institute, 2016
Abu Dhabi, United Arab Emirates

101 Participants from 13 Countries
29 % women
Nanotechnology, sustainable Living, Neuroscience, Petroleum Geosciences Spacecraft Technologies

Université Mohammed V de Rabat, École Nationale Supérieure d'Informatique et d'Analyse des Systèmes, 2017
Rabat, Morocco

114 Participants from 13 Countries
32% women
Water, Sanitation and Hygiene, Renewable Energy, Precision Medicine and Cancer, Smart Agriculture, Smart Cities.

About KFAS

The Kuwait Foundation for the Advancement of Sciences (KFAS) continues on its 40-year journey to harness science, technology and innovation in Kuwait, as well as to promote modernization, a better quality of life and a sustainable future for the Kuwaiti people. In line with the long-term vision of the late Amir Sheikh Jaber Al Ahmad Al Jaber Al Sabah and supported by leaders in the private sector, an Amiri Decree was issued in 1976 for the establishment of the Foundation, with a focus on advancing and integrating science, technology and innovation (STI) throughout the country.

The Foundation's efforts toward fostering STI to address national challenges first began through the pledge made by the private sector shareholding companies to fund the Foundation based on a set percentage of their annual profits — currently at one percent — as well as through the incorporation of a unique governance modality, in which the Board of Directors is chaired and appointed by the Amir of the State of Kuwait. Today, KFAS's impact is prominently embedded within the country's scientific and technological accomplishments and advancements.

Under the new KFAS 2017-2021 strategy, the Foundation has renewed its commitment to play a leading role as a catalyst for supporting efforts to transform the country into a knowledge-driven economy. This includes investing in human resource development and driving research projects that provide innovative solutions to challenges of national priority.

The Foundation's strategic objectives have focused on promoting and harvesting STI for four main stakeholders: society at large (especially the youth), the research community, the private sector and the government. Programs and initiatives have been developed to promote and advocate STI through the dissemination of knowledge via several strategic channels, including scientific publications as well as sponsoring and organizing community-based events. Through collaborations with local and international institutions, efforts are also aimed at raising the quality of research and driving innovative solutions for key areas of national priority. Furthermore, the Foundation continues to work on enhancing the development of a competent private sector by investing in its human capital and increasing investment in STI. A key part of the Foundation's new strategic plan is dedicated to supporting strategic partnerships with international centers of excellence, in order to foster and promote the advancement of its strategic objectives and the national innovation ecosystem. The Foundation has also established and funded specialized centers of excellence to implement the Foundation's strategic objectives, addressing national challenges through research and innovation.

The Foundation will continue to advance its strategy, acting as a catalyst for the integration of a rich scientific culture into the fabric of Kuwaiti society and enabling a sustainable, knowledgeable and robust economy.

About NASEM

The U.S. National Academies of Sciences, Engineering, and Medicine are private, nonprofit institutions that provide independent, objective analysis and advice to the nation to solve complex problems and inform public policy decisions related to science, technology, and medicine. The National Academies operate under an 1863 congressional charter to the National Academy of Sciences, signed by President Abraham Lincoln.

The National Academies conduct studies that bring together experts from across disciplines to look at evidence with fresh eyes and openness to insights from other fields. These study committees survey the landscape of relevant research, hold public meetings to gather information, and deliberate to reach consensus, which results in a shared understanding of what the evidence reveals and the best path forward. The National Academies also convene workshops, symposia, and other events that bring together experts and practitioners to consider issues related to science, engineering, and medicine and their implications for policy and practice.

In addition to its landmark studies and convening activities, the National Academies pursue a range of initiatives to strengthen the scientific, engineering, and medical fields and their capacity to contribute to human welfare. This includes supporting fellowship programs that foster the career development of young scientists and collaborating with the academies of other nations that advance science globally.

Program

6TH ARAB-AMERICAN FRONTIERS OF SCIENCE, ENGINEERING AND MEDICINE SYMPOSIUM Kuwait National Library

Saturday November 3rd	
19:30	Welcoming Dinner
Day 1: Sunday November 4th	
8:15	Buses leave to Kuwait National Library
9:00	Opening Ceremony
9:45	Coffee Break & Group Picture
Session I: Big Data	
10:15	**Session Chairs:** Miriah Meyer, University of Utah, United States Wei Lee Woon, Khalifa University, United Arab Emirates **Presentations:** *Humans, machines and data: Understanding challenges and opportunities* Enrico Bertini, NYU, United States *Towards a unifying theory of learning and information* Ibrahim Alabdulmohsin, Saudi Aramco, Saudi Arabia *Computational social science: Using big data as a societal microscope* Kinga Makovi, NYU Abu Dhabi, United Arab Emirates *Machine learning driven biomarker discovery in the era of big data* Bobbie-Jo Webb-Robertson, Pacific Northwest National Laboratory, United States
11:45	Panel Discussion
12:30	Lunch
Session II: Water Systems	
13:30	**Session Chairs:** Hassan Arafat, Khalifa University, United Arab Emirates Jeremy Guest, University of Illinois at Urbana-Champaign **Presentations:** *Sustainable reuse options of wastewater in Oman* Mahad Baawain, Sultan Qaboos University, Oman *The who, where, and (somewhat) why of the drinking water microbiome* Ameet Pinto, Northeastern University, United States *A potential collaboration with Water Research Center of Kuwait Institute for Scientific Research on innovative desalination technologies* Mansour Ahmed, Kuwait Institute for Scientific Research, Kuwait *Sustainable bioinspired water purification* Manish Kumar, Pennsylvania State University, United States
15:00	Panel Discussion
15:40	Flash Talks [1-34]
16:15	Poster Session & Coffee Break

17:45	Buses leave to Dar Al Athar Al Islamiyyah for a tour of the collection (optional), or take the bus to the hotel
19:30	**Gala Dinner at Dar Al-Athar Al-Islamiyyah (buses leave at 19:00 pm from Hotel)**
21:00	Buses return to hotel
Day 2: Monday November 5th	
8:15	Buses leaves to Kuwait National Library
Session III: The Microbiome	
9:00	**Session Chairs:** Hussain Mahdi Bahbahani, Kuwait University, Kuwait Leonard Pease, Pacific Northwest National Laboratory, United States **Presentations:** *Unraveling interactions between the microbiome and the host immune system to decipher mechanisms of disease.* Catherine Lozupone, University of Colorado, United States *Antimicrobial activity of lactic acid bacteria and antimicrobial peptides from camel milk* Rita Rahmeh, Kuwait Institute for Scientific Research, Kuwait *Functionality of the maternal microbiome* Jennifer Fettweis, Virginia Commonwealth University, United States *Pharmacomicrobiomics: How our microbiome cloud affects precision therapeutics* Ramy Karam Aziz, Cairo University, Egypt
10:30	Panel Discussion
11:15	Coffee Break
11:30	**NASEM Programs** *NASEM International Activities* John Boright, Executive Director of International Affairs, National Academy of Sciences, United States *Arab-American Frontiers Fellowships* Daniel Placht, National Academy of Sciences, Engineering, and Medicine, United States
12:30	Lunch
Session IV: Air Quality	
13:30	**Session Chairs:** Christa Hasenkopf, Open AQ, United States George Mitri, University of Balamand, Lebanon **Presentations:** *Global air quality: Challenges and opportunities* Christine Wiedinmyer, University of Colorado, United States *Examining the challenges in mainstreaming climate change in development plans: Lessons learned from Lebanon* Lea Kai, Ministry of the Environment, Lebanon *New high-resolution global composition forecast* Emma Knowland, National Aeronautics and Space Administration, United States *Putting air quality data to work – Opportunities and challenges of fine-grained spatial and temporal air quality information* Karim Tarraf, Hawa Dawa and Cairo University, Egypt *Air Quality Data and Awareness in Kuwait* Bader Albusairi, Kuwait University
15:00	Panel Discussion

15:40	Flash Talks [35-69]
16:20	Poster Session & Coffee Break
17:45	**Cultural Event: trip to Souk Al-Mubarakiya (optional)** or take the bus to the hotel
19:30	**Cultural Dinner Shammam restaurant (Mubarakiya)** (buses leave at 19:00 pm from hotel)
21:00	Buses return to hotel
Day 3: Tuesday November 6th	
8:15	Buses leaves to Kuwait National Library
Session V: Next Generation Buildings and Infrastructure	
9:00	**Session Chairs:** Laila Khodeir, British University in Egypt, Egypt Hussam Mahmoud, Colorado State University, United States **Presentations**: *Scalable architectural visions!* Raya Ani, American Institute of Architects-Middle East, United Arab Emirates *Controlling thermal radiation for large scale energy applications* Xiaobo Yin, University of Colorado, United States *Reimagining heritage and public space in Fez, Morocco* Aziza Chaouni, University of Toronto and Aziza Chaouini Projects (Fez), Morocco *Programmable skins: A hygromorphic approach for low-cost adaptive building façades* Sherif Abdelmohsen, American University of Cairo, Egypt
10:30	Panel discussion
11:15	Coffee Break
11:30	**KFAS and Regional Research & Funding Opportunities** *KFAS as a catalyst of change- Research Grants* Batoul M Dawi, Research Grants, Kuwait Foundation for the Advancement of Sciences, Kuwait *KFAS as a catalyst of change- Collaborative Research Unit* Yousef Aleneze, , Kuwait Foundation for the Advancement of Sciences, Kuwait *Importance of international collaborations in research and innovation programs:* Examples from Oman Ali Al Shidhani, The Research Council, Oman
12:15	**Closing Remarks and Certificates** Esra Aleisa Joy Ward
12:30	Lunch
2:00	Buses leave to Hotel
16:00	Busses leave from Hotel to (optional): **1. Kuwait Scientific Center/Aquarium** or **2. Avenues Mall**
20:00	Buses return to hotel

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Director General's Message

About 100 promising scientists, engineers and medical professionals, journeying from the Arab countries and the United States, are gathered in Kuwait, for the Sixth Arab American Frontiers. Once again, the Frontiers convenes in Kuwait where it all started. In 2011, the Kuwait Institute for Scientific Research joined forces with the National Academy of Sciences to pioneer this platform, with a view of encouraging and strengthening scientific collaboration, and enabling technology transfer across disciplines, within and beyond the Arab region, towards empowering young researchers, engineers and medical professionals to assume leadership roles in their fields.

In our new 2017-2021 strategy, KFAS strives to fulfill 3 main strategic goals:
1) Advocating a scientific culture to enhance science, technology and innovation throughout the community, with a particular emphasis on the youth
2) Fostering research and development, through investment in research projects, building researchers' capacities and the deployment of innovative technologies to address national priority issues
3) Enhancing the growth and diversification of the private sector through science, technology and innovation (STI).

Establishing a network of early career scientists is essential for KFAS to sustain its long-term scientific advancement and catalyze future engagement of these scientists. Under its new Strategy, KFAS offers many opportunities to strengthen scientific dialogue between early career researchers and senior scientists. This translates into augmenting platforms such as the Frontiers that celebrates accomplished young scientists and enhances scientific dialogue and exchange among young researchers in Arab countries and the United States, including Arab scientist in diaspora. KFAS is actively providing such opportunities for early career scientists to connect with each other, and for their voices to be heard. In this context, KFAS promotes the development of current and future leadership, builds capacity, and provides platforms to encourage high achievements in research, technology and innovation.

By hosting the Sixth meeting, KFAS renews its commitment to play a leading role in supporting national efforts towards transforming Kuwait into a knowledge-driven economy. Through our partnership with national, regional and international institutions, KFAS is well situated to fulfill its mission and play its role as a catalyst of STI for the benefit of society, research and enterprise in Kuwait and globally.

Moreover, KFAS promotes science as a bridge for strengthening international relations and consolidating mutual understanding between societies, as science is one of the most important constituent of our common human heritage and means for collaborative work. KFAS is hosting this scientific conference as an expression of its vital role in this field, and is an embodiment of the guidance of His Highness the Amir Sheikh Sabah Al-Ahmad Al-Jaber Al-Sabah, the Chairman of KFAS, who further highlighted the importance of exchange between communities and building relations within scientific fields, which are the basis for development, security and peace between states and societies.

I wish you every success in your deliberations over the next three days, and I hope you enjoy your stay in Kuwait.

Dr. Adnan Shihab-Eldin
Director General

Institutional Biographies

NASEM

National Academies of Sciences, Engineering, and Medicine

John Boright

Executive Director of International Affairs
National Academy of Sciences
Washington, DC
United States

Dr. John P. Boright is the executive director of international affairs of the US National Academies. International activities of the National Academies include cooperation with national, regional, and global groups of counterparts. A central goal of these cooperative activities is to build the capacity of the science, engineering, and medical communities to successfully engage in meeting local, national and global needs, and to inform policy making. Boright has served in several governmental positions including: deputy to the associate director for national security and international affairs, Office of Science and Technology Policy, Executive Office of the President; deputy assistant secretary for science and technology affairs, Department of State; director of the Division of International Programs, National Science Foundation; and counselor for scientific and technological affairs, U.S. Embassy in Paris. He received a BA (high honors) and PhD in physics from Cornell University.

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Kuwait Foundation for the Advancement of Sciences

Ameenah Farhan

Ameenah Farhan
Head of Physics Department at Kuwait University (KU)
Kuwait City
Kuwait

Dr. Farhan is currently the Head of Physics Department at Kuwait University. Also she serves as a Senior Advisor to Director General at KFAS and on the Board of Trustees of Jaber Al-Ahmed Center for Nuclear Medicine and Molecular Imaging. She was also Acting Director for Research Directorate and Vise Dean for Research and Laboratories Affairs in the Faculty of Science at KU. She also serves as a Senior Advisor to Director General at KFAS and on the Board of Trustees of the Jaber Al-Ahmed Center for Nuclear Medicine and Molecular Imaging. She was also the Vice Dean for Research and Laboratories Affairs, in the Faculty of Sciences at Kuwait University. Her research interests include Nuclear Structure and Astrophysics, Nuclear Data Evaluation, and Environmental Radioactivity, where her contributions have led to several publications in these fields. She is also a member of the American Physical Society, and the American Academy for the Advancement of Science. Since 2015, she has served as a Jury member of “L’Oreal-UNESCO For Women in Science-Middle East. Professor Farhan is passionate about, and is an advocate for, physics education, especially in its promotion and enhancement at the undergraduate and graduate level.

NASEM

National Academies of Sciences, Engineering, and Medicine

Dalal Najib

Senior Program Officer
National Academy of Sciences
Washington, DC
United States

Dalal Najib is a senior program officer at the Development, Security and Cooperation (DSC) in the Policy and Global Affairs (PGA) Division of the U.S. National Academies of Sciences, Engineering and Medicine, working mainly on international development and capacity building through science and technology. She is the program director for the Arab-American Frontiers program of Science, Engineering and Medicine at NAS in partnership with MENA based S&T institutions. Dalal also works on the PEER (Partnership for Enhanced engagement in Research) program where she oversees the Central Asia region portfolio. Dalal first joined the National Academies as a Mirzayan Science and Technology policy fellow at the Aeronautics and Space Engineering Board (ASEB). She holds a PhD in space physics and engineering from University of Michigan, under the NASA Earth and Space Sciences Fellowship (NESSF). She also completed a master's degree in public policy (MPP) from the Gerald Ford School of Public Policy at the University of Michigan with focus on science and technology policy in developing countries. Prior to that, Dalal received her undergraduate degree in aerospace and aeronautical engineering from Supaero (Toulouse, France). She is fluent in French, Arabic, English and Spanish.

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Layla Al-Musawi

Program Manger
Scientific Culture Directorate
Kuwait Foundation for the Advancement of Sciences (KFAS)
Kuwait City
Kuwait

Dr. Al-Musawi is the program manager for Publicizing and Dissemination of Science and Technology, within the Scientific Culture Directorate at the Kuwait Foundation for the Advancement of Sciences. Dr. Al-Musawi has also served as the Monitoring and Evaluation Advisor to the Director General of the International Center for Biosaline Agriculture (ICBA), and was the team leader of the Kuwait Food Security and Investment Strategy, developed by ICBA, for the Kuwait Investment Authority (KIA). Prior to that, she served as the Scientific Consultant and Program Manager to the Regional Organization to Protect the Marine Environment (ROPME) in Kuwait. Dr Al-Musawi was also extensively involved in the Kuwait Environmental Rehabilitation Program (KERP) to remediated war related damages, funded by the United Nation Compensation Commission (UNCC). She was the lead author to realign Kuwait's National Strategy and Action Plan (NAP) with the 10-Year Strategy of the United Nation Convention to Combat Desertification.

NASEM

National Academies of Sciences, Engineering, and Medicine

Daniel Placht

Associate Program Officer
National Academy of Sciences
Washington, DC
United States

Daniel Placht is an associate program officer in the Development, Security, and, and Cooperation unit of the U.S. National Academy of Sciences (NAS). He currently works on the Arab-American Frontiers and PEER programs which focus on international development and capacity building through improved access to science and technology. Before joining NAS, Daniel interned at the International Law Institute in Washington, DC as well as multiple international development NGOs in Cairo, Egypt. He holds an undergraduate degree in international affairs from Bard College in New York.

KFAS

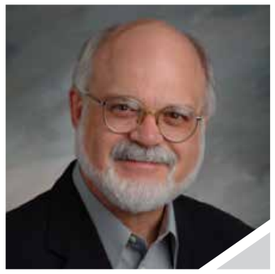
Kuwait Foundation for the Advancement of Sciences

Hayfaa Almudhaf

STI Consultant
Kuwait City
Kuwait

Ms. Almudhaf played a key role in the initiation of the National Academy of Sciences (NAS) Arab American Frontiers Program, and in hosting the first conference in Kuwait in 2011. Before retiring engineer Almudhaf has been a Senior Advisor at the Kuwait Institute for Scientific Research (KISR) since 2008. She has been actively involved in scientific research for 18 years in disciplines related to building and energy efficiency, which have resulted in more than 50 technical reports and scientific papers. She has also held the position of the Manager of the Building and Civil Engineering Department at KISR. Engineer Almudhaf was a Member of the Founding Board of Directors for the Environment Public Authority (EPA) in Kuwait. She was the Chairperson of the Higher Organizing Committee of the International Conferences on Women Leaders in Science, Technology and Engineering in 2007.

Oversight Committee



John G. Hildebrand (Chair)

Foreign Secretary, U.S. National Academy of Sciences
Regents Professor, Department of Neuroscience
University of Arizona
Tucson, Arizona
United States

John Hildebrand is Regents Professor of Neuroscience and Professor of Chemistry & Biochemistry, Ecology & Evolutionary Biology, Entomology, and Molecular & Cellular Biology at the University of Arizona in Tucson. He earned his baccalaureate degree at Harvard University in 1964 and his PhD at the Rockefeller University in 1969 and moved to the University of Arizona in 1985 after 16 years on the faculties of Harvard and Columbia Universities. He was the founding head of the University's Division of Neurobiology (1985-2009) and of the Department of Neuroscience after the Division became a Department (2009-2013). He also was a founder of the Center for Insect Science (1988) and School of Mind, Brain and Behavior (2009).

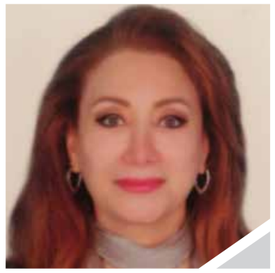
He is an author of more than 215 research papers and reviews, editor of five books, and recipient of numerous national and international honors and awards. Among his strongest interests is education at all levels. For example, he served the International Brain Research Organization (IBRO) as chair (1992-98) of its Committee on Developing Countries and chair (2001-10) of its Board of Neuroscience Schools, advocating for and teaching in intensive schools in South America and Southern Europe. A past president of the Association for Chemoreception Sciences, International Society of Chemical Ecology, and International Society for Neuroethology, he currently is the elected Foreign Secretary of the U.S. National Academy of Sciences and a member of the American Academy of Arts and Sciences, American Philosophical Society, German National Academy of Sciences 'Leopoldina', Norwegian Academy of Science and Letters, and Royal Norwegian Society of Sciences and Letters; an Honorary Fellow of the Royal Entomological Society (UK); and a fellow of the AAAS, the Entomological Society of America, and the International Society for Neuroethology.

His research interests include Neurobiology, neuroethology, and chemical ecology of insects and other arthropods, especially: functional organization and neurophysiology of the olfactory system; behavior, particularly interactions with mates and plant and animal hosts; biology of arthropod vectors of disease, mainly triatomine vectors of Chagas Disease; and postembryonic, metamorphic development of the central nervous system. For many years he had two parallel careers: as an academic scientist and as a musician.

Teofilo (Jun) Abrajano

Director of the Office of Sponsored Research
Office of Competitive Research Funds
King Abdullah University of Science and Technology
Thuwal
Saudi Arabia

Dr. Jun Abrajano is the director of the Office of Sponsored Research (OSR) at KAUST. He came to KAUST from the US National Science Foundation (Arlington, VA), where he held various positions including head of Surface Earth Processes Section, division director of Earth Sciences, and deputy assistant director of the GEO Directorate. Prior to joining NSF, Dr. Abrajano was a professor of earth and environmental sciences at Rensselaer Polytechnic Institute (Troy, NY) and the director of its Environmental Sciences Program, professor and chair of environmental sciences at Memorial University (St. John's, Canada), and scientist at the Chemical Technology Division of Argonne National Laboratory (Lemont, IL). He is a geochemist who specializes in high precision stable isotope mass spectrometry and its many applications to unraveling biogeochemical cycling and environmental processes in modern and ancient aquatic systems. Dr. Abrajano received his PhD in earth and planetary sciences from Washington University (St. Louis, MO). He is a Fulbright Fellow and a Fellow of the Geological Society of America.



Sabah AlMomin

Research Scientist
Kuwait Institute for Scientific Research
Shuwaikh
Kuwait

Dr. Sabah AlMomin is a research scientist at Kuwait Institute for Scientific Research (KISR). She holds a PhD in genetic engineering from University of Surrey, United Kingdom and an MSc in library and information sciences from Clarion University of Pennsylvania, USA. She is one of the pioneers in the field of genetic engineering and biotechnology in Kuwait and has introduced and worked on several advanced technologies, such as the development of diagnostic DNA probes, recombinant vaccines, embryo transfer and cloning in sheep, biotyping, transgenic plants and investigating algae as a potential feed. In addition, she established a field of research on fish population assessment using molecular techniques and published the first genome sequence of silver pomfret, a fish of high economic value in Kuwait and the region. Through much of her collaborative efforts, the Biotechnology Department at KISR was established with high standards of laboratories. Currently, Dr. AlMomin is leading an ambitious government initiative to establish a National Centre of Genetic Engineering and Biotechnology.

Dr. AlMomin is an elected fellow of the prestigious organization, The World Academy of Sciences (TWAS) in Italy, as well as represents the State of Kuwait as a liaison officer at the International Centre for Genetic Engineering and Biotechnology (ICGEB). She is a certified professional in biorisk management from the International Federation of Biosafety Associations (IFBA), USA. Dr. AlMomin has been involved in establishing regional biosafety and biosecurity, joining a regional effort for the Middle East and North Africa (MENA) along with the International Council of Life Sciences (ICLS) in Washington.

Dr. AlMomin is a member of the Organization of Women in Science in the Developing Countries (OWSD) and a co-chair of the Gender Advisory Panel (GAP) in association with TWAS where she is very active in promoting science, especially women scientist, of the developing world. She is a member of several national and international committees.

Essam Asem

Scientific Advisor
Kuwait Foundation for the Advancement of Sciences
Kuwait City
Kuwait

Dr. Essam Asem obtained a BSc Honours degree in 1985, an MSc degree in 1989 and a PhD in 1993, all of which were attained at the UK and in the field of mechanical engineering. He served for over 23 years at the Kuwait Institute for Scientific Research (KISR) conducting applied research in the field of energy conservation and efficiency. He also served for five years at the Arab Fund for Economic and Social Development with an emphasis on investment appraisal in private industrial projects.

Dr. Asem has been working at the Kuwait Foundation for the Advancement of Sciences (KFAS) since 2012 and during his tenure the he has served as the Director of Innovation and Enterprise, Director of Research and is currently serving as the Scientific Advisor. He served in numerous committees, reviewed many papers for Q1 journals and published many technical reports, book chapters, conferences, and journal papers.

Rula Deeb

Principal Engineer
Geosyntec Consultants
Oakland, California
United States

Rula A. Deeb, Ph.D., is a senior principal at Geosyntec Consultants in Oakland, California. Her expertise includes groundwater and soil remediation with an emphasis on site closure strategies, in-situ technologies, and the environmental fate, transport and treatment of emerging contaminants. Rula has developed and implemented research programs in collaboration with scientists and engineers at universities, consulting firms and the federal government to address remedial issues at complex sites. Her research has been recognized with awards from the National Science Foundation, U.S. Environmental Protection Agency, Water Environment Federation, American Society of Civil Engineers, American Society for Microbiology, American Association of University Women, Air and Waste Management Association, and the American Chemical Society. She is the 2007 recipient of the UC Berkeley Engineering Innovation Award in the category of Outstanding Young Leader. Rula is a Board Certified Environmental Engineering Member of the American Association of Environmental Engineers.

Samir El-Ghazaly

Distinguished Professor
Department of Electrical Engineering
University of Arkansas
Fayetteville, Arkansas
United States

Samir M. El-Ghazaly is a distinguished professor in the Department of Electrical Engineering at the University of Arkansas. He has completed two detail assignments at the U.S. National Science Foundation (NSF): From August 2013 to August 2016, he served as the director of the Division of Electrical, Communications and Cyber Systems at NSF. This division supports research in advanced areas of critical importance for the U.S. economy and defense. Its annual budget is about $115 million. From September 2009 to August 2012, he served as a program director for electronics, photonics and magnetic devices in the Division of Electrical, Communications and Cyber Systems.

Dr. El-Ghazaly received his PhD degree in electrical engineering in 1988 from The University of Texas, Austin. After graduation, he joined Arizona State University as an assistant professor in the Department of Electrical Engineering, where he became associate professor in 1993 and professor in 1998. From August 2002 to July 2007, he served as the head of the Department of Electrical and Computer Engineering at The University of Tennessee, Knoxville. From August 2007 to June 2013, he was the head of the Department of Electrical Engineering and holder of the Twenty-First Century Leadership endowed Chair in Electrical Engineering at University of Arkansas. He received the Distinguished Educator Award from the IEEE Microwave Theory and Techniques Society in 2015.

He trained and worked at several universities and research centers including Cairo University; the Centre Hyperfrequences et Semiconducteurs at Université de Lille I in France; NASA's Jet Propulsion Lab in Pasadena, California; CST-Motorola, Inc.; iemn, Université de Lille, France; and the Swiss Federal Research Institute (ETH). His research interests include microwave and millimeter-wave semiconductor devices and circuits, semiconductor device simulations, electromagnetics, antennas, and numerical techniques applied to monolithic microwave integrated circuits.

Dr. El-Ghazaly is the 2017 vice president of the Institute of Electrical and Computer Engineering (IEEE) and the chair of the Publication Services and Products Board. He is a fellow of IEEE. He was the chairman of Commissions A and D of the U.S. National Committee of URSI. He was an elected member of the Administrative Committee of the IEEE Microwave Theory & Techniques Society (2001-13). He was the editor-in-chief for the IEEE Microwave and Wireless Components Letters (2001-03). He was the chairman of MTT-15 Committee on Field Theory. He was the general chairman of the IEEE MTT-S International Microwave Symposium, Phoenix, Arizona, May 2001. He was the chairman of the IEEE MTT-S Publications Committee (2004-08). Dr. El-Ghazaly was the president of the IEEE Microwave Theory and Techniques Society (2010). He also served as the chair of the IEEE Technical Activities Board's Periodicals Committee (2012-13), the vice chair of the IEEE Publications Services and Products Board (2013), and the chair of the IEEE-TAB Periodical Review and Advisory Committee (2014-15). He was the vice chair of the IEEE MTT-S Awards Committee (2013 - 16).

Sunil Kumar

Vice Provost of Graduate and Postdoctoral Programs
Global Professor of Engineering
New York University Abu Dhabi
Abu Dhabi
United Arab Emirates

Sunil Kumar is the vice provost of graduate and postdoctoral programs at New York University Abu Dhabi and a Global Professor of Engineering at New York University, with concurrent appointments in Abu Dhabi and New York. He is a mechanical engineer whose scholarly research focuses on the transport of light and thermal radiation, specifically interaction of lasers with surfaces and scattering media, optical phenomena and devices, fire dynamics, thermal-fluid analysis, and applied mathematics. He was the Dean of Engineering at NYU Abu Dhabi from 2009 to 2015, and previously was graduate dean and associate provost, and former head of the Department of Mechanical, Aerospace, and Manufacturing Engineering at New York University, Tandon School of Engineering. He taught at the University of California Berkeley, was a scientist at the Lawrence Berkeley Lab, and a visiting scientist at NASA's Ames Research Center.

Kumar is the research leader for NYU's Fire Research efforts, including the Advanced Learning Through Integrated Visual Environments (ALIVE) project, which educates, trains, and disseminates critical information to both career and volunteer firefighters via a unique game-based computer program. Kumar holds a B.Tech. from the Indian Institute of Technology, Kharagpur; an MSc and MA from the State University of New York, Buffalo; and a PhD from the University of California, Berkeley. Kumar is a Fellow of the American Society of Mechanical Engineers.

Tod A. Laursen

President and Professor of Mechanical Engineering
Khalifa University
Abu Dhabi
United Arab Emirates

Tod A. Laursen is the president of Khalifa University of Science, Technology and Research, in Abu Dhabi, United Arab Emirates. Prior to becoming president of Khalifa University, Dr. Laursen was a member of the faculty of Duke University (USA), between the years of 1992 and 2010, during which time he had appointments in civil engineering, biomedical engineering, and mechanical engineering. He served as Chair of the Department of Mechanical Engineering and Materials Science from 2008-2010, and served as Senior Associate Dean for Education in the Pratt School of Engineering from 2003-2008. In the latter capacity, he had oversight responsibility for all undergraduate and graduate engineering programs at Duke.

Dr. Laursen earned his PhD and MSc postgraduate degrees in mechanical engineering from Stanford University and a BSc in the same subject from Oregon State University. He specializes in computational mechanics, a subfield of engineering mechanics concerned with development of new computational algorithms and tools used by engineers to analyze mechanical and structural systems. He has published over 100 refereed articles, book chapters, and abstracts, and has authored or co-edited two books. His particular focus is development of methods to analyze contact, impact and frictional phenomena, in highly nonlinear and complex systems.

He is a Fellow of the American Society of Mechanical Engineers, the International Association of Computational Mechanics, and the United States Association for Computational Mechanics. He also holds memberships in the American Society for Engineering Education and Tau Beta Pi. He served as an at-large member of the Executive Committee for the United States Association for Computational Mechanics between 2007 and 2010, and currently services as a member of the Executive Council of the International Association for Computational Mechanics (until 2020). Additionally, he has served on the scientific advisory committees of several of the most important national and international congresses in computational mechanics.

Andrew Nagy

Professor Emeritus
University of Michigan
Ann Arbor, Michigan
United States

Andrew F. Nagy is a professor emeritus in the Department of Climate and Space Sciences and Engineering at the University of Michigan. He has been involved as an interdisciplinary scientist on numerous projects for NASA including the Pioneer Venus and Dynamics Explorer missions as well as a multitude of other satellite and geospatial oriented projects.

Dr. Nagy has been the chair or member of 37 national and international committees for NASA, NSF, NAS, COSPAR, and IAGA and has authored about 400 publications and presented papers at over 200 scientific events. He is the recipient of the AGU Fleming Medal and Kaula Prize, the NASA Public Service Award, McLaurin Prize, Fulbright Award, and the Distinguished Faculty Achievement Award from the University of Michigan.

Dr. Nagy earned his PhD in electrical engineering in 1963 and his research interests include the ionospheres of Mars, Venus, Jupiter, Saturn, Europa, Io, and Titan, comparative planetology, MHD modeling of the solar wind and planetary interaction, and low energy plasmas in the Earth's magnetosphere.

Fawwaz Ulaby

Emmett Leith Distinguished University Professor of Electrical Engineering and Computer Science
The University of Michigan
Ann Arbor, Michigan
United States

Professor Fawwaz T. Ulaby is the Emmett Leith Distinguished University Professor of Electrical Engineering and Computer Science at the University of Michigan. Previously, he served the university as vice president for research from 1999 to 2005. His research involves the use of radar to map terrestrial geophysical features from satellite platforms. In 2006 and 2007 he served as the chair of the Radar Review Team for the Phoenix spacecraft that landed on Mars in May of 2008.

Prof. Ulaby is a member of the National Academy of Engineering, Fellow of IEEE and AAAS, and serves or has served on several scientific boards and commissions, including the Committee on Human Rights of the National Academies (2006-2012).

Since joining the University of Michigan faculty in 1984, Professor Ulaby has directed numerous interdisciplinary, NASA-funded projects and served as the founding director of a NASA-funded Center for Space Terahertz Technology. He has authored 16 books, published over 700 journal articles, and he has supervised 115 graduate students. Many of his textbooks have been translated into Chinese, Korean, Portuguese, and other languages. He is the recipient of the NASA Achievement Award (1990), the IEEE Millennium Medal (2000), the 2002 William Pecora Award – a joint recognition by NASA and the Department of the Interior, and the 2006 EECS Professor of the Year Award from EKN. In 2006 he was awarded the Thomas Edison Medal, and in 2012 he received the IEEE Education Medal.

Organizing Committee

Esra Aleisa
(Committee Co-Chair)

Associate Professor
Kuwait University
Kuwait

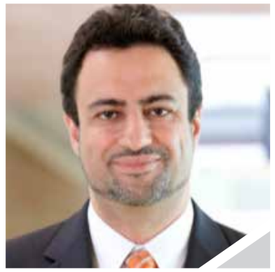
Dr. Esra Aleisa is an associate professor of industrial and management systems engineering at Kuwait University. She received her master's and PhD in industrial engineering at the State University of New York in 2001 and 2005, respectively. Her research is devoted to the formulation, modeling, evaluation, analysis and optimization of life cycle assessment applications, mainly in the fields of desalination and treatment of municipal waste and water. She served as vice dean for planning and career development at the College of Engineering and Petroleum at Kuwait University. Aleisa has worked on projects in collaboration with the United Nations Commission Committee (UNCC) in regard to post war environmental remediation; and the United Nations Environment Programme (UNEP) and the United Nations Industrial Development Organization (UNIDO) on a project for national resource efficiency and cleaner production in Kuwait. She is a certified project management professional and a member of several professional societies.

Joy Ward
(Committee Co-Chair)

Associate Dean for Research and Dean's Professor
The University of Kansas
Lawrence, Kansas
United States

Joy has a depth of experience in both research and leadership that spans local, national, and international levels. Her research has led to major advances in understanding plant responses to a rapidly changing global environment. By incorporating the fossil record, she has provided novel insights into how plants have responded to long-term environmental changes since the last glacial period, as well as understanding how plants will respond to environmental change of the future. She has received long-term funding from the National Science Foundation (NSF) through her work in plant biology and was awarded the Presidential Early Career Award for Scientists and Engineers (PECASE) from President Obama and the NSF CAREER Award.

At the University of Kansas, she has received the University Scholarly Achievement Award in STEM research, the Thelma and Edward Wohlgemuth Endowed Chair, the K. Barbara Schowen Undergraduate Research Mentor Award, and was named a University of Kansas Woman of Distinction. She is also a Kavli Fellow and served as U.S. chair for the National Academy's Frontier of Sciences through the Japanese-American and Arab-American programs, and has been a scientific delegate to Uzbekistan through the American Association for the Advancement of Science and through the State Department. She has been a KU senior administrative fellow and will soon graduate from the Food Systems Leadership Institute, a two-year executive leadership training program through the APLU (Association of Public & Land-grant Universities). She has mentored many successful students at the undergraduate, graduate, and post-doctoral levels, and has been a mentor for several NIH programs to enhance diversity in STEM fields.



Hassan A. Arafat

Director, Center for Membrane and Advanced Water Technology
Professor of Chemical Engineering
Khalifa University of Science and Technology
Abu Dhabi
United Arab Emirates

Prof. Arafat is the director of the Center for Membrane and Advanced Water Technology and professor of chemical engineering at Khalifa University of Science and Technology in Abu Dhabi, UAE. His current research expertise is in membrane-based desalination, with focus on third-generation desalination technologies such as membrane distillation (MD) and the development of novel membranes thereof. He initiated a new research trend on sustainable desalination, which integrates multiple multidisciplinary tools to enhance the prospects of deploying desalination, with the aim of achieving national water and food security. The concepts behind this trend are captured in his book: Desalination Sustainability: A Technical, Socioeconomic and Environmental Approach.

Prof. Arafat received his Ph.D. in Chemical Engineering from the Univ. of Cincinnati (Ohio, USA) in 2000 and a BSc in Chem. Eng. From the Univ. of Jordan. From 2000 to 2003, he worked at Argonne National Laboratory (Illinois, USA) as a postdoc then as a research scientist, developing processes for nuclear waste treatment at the United States Department of Energy (DOE) sites. Between 2003 and 2010, he was a faculty member of the Chem. Eng. Dept. at An-Najah University (Palestinian Territory). Between 2009 and 2012, he served as an adjunct associate professor of the Biological Eng. Dept. at Utah State Univ. (Utah, USA) and in 2010, he was a visiting scholar at the Massachusetts Institute of Technology (Massachusetts, USA). He is a recipient of research fellowships by the Open Society Foundation (USA) and DAAD (Germany).

Through his career thus far, he supervised 30 postdoctoral fellows and graduate students and received 23 research grants, exceeding $13 Million in funding. His research was published in more than 225 book chapters, journal papers and conference presentations, in addition to two US patents and 50 keynote and invited talks worldwide. Among other honors, Prof. Arafat received the Khalifa Award for Education, presented by the President of UAE, the Mohammad Bin Rashid Medal for Scientific Excellence, presented by the Prime Minister of UAE, the United States Department of Energy Secretarial Honor Award, the Mondialogo Engineering Award by Daimler AG and UNESCO, and the Univ. of Cincinnati Distinguished Dissertation Fellowship.

Hussain Bahbahani

Assistant Professor of Genetics
Kuwait University
Faculty of Science - Department of Biological Sciences
Kuwait

Hussain Bahbahani has been an assistant professor of genetics at Kuwait University since 2015. He obtained his bachelor's degree in genetics from Aberdeen University, UK in 2008. This was followed by a master's degree in medical biosciences from the University of Newcastle upon Tyne, UK in 2009. In 2011, Dr. Bahbahani started his PhD degree at University of Nottingham specializing in animal population genetics. His PhD was completed in the summer of 2015 when he was appointed as an assistant professor at Kuwait University. He has contributed to several scientific publications published in peer-reviewed international journals. Dr. Bahbahani is now a director of the National Unit for Environmental Research and Services at Kuwait University and is the founder of the Unixomic group, which is specialized in training people in analyzing large data effectively using computer software that relies on writing specific codes.

Jeremy S. Guest

Assistant Professor
University of Illinois at Urbana-Champaign
Champaign, Illinois
United States

Dr. Jeremy Guest is an assistant professor in the Department of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign (UIUC). His research focuses on the development of technologies for sustainable water and sanitation, with a focus on resource recovery from bodily excreta in technologically advanced and developing communities. Dr. Guest is engaged with several major initiatives at UIUC, where he serves as the Environmental Sustainability Lead for the Soybean Innovation Lab funded by the U.S. Agency for International Development (USAID) and the Sustainable Design Lead for the Center for Advanced Bioenergy and Bioproducts Innovation funded by the U.S. Department of Energy (DOE). Dr. Guest is the recipient of a National Science Foundation (NSF) Faculty Early Career Development Program (CAREER) Award, the 2016 recipient of the Paul L. Busch Award for innovation in applied water quality research from the Water Research Foundation (WRF), and a Beckman Fellow of the Center for Advanced Study at UIUC. His research has been sponsored by a number of agencies including the NSF, the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. DOE, the USAID, and the Bill and Melinda Gates Foundation. Dr. Guest's formal training includes a BSc and MSc in civil engineering from Bucknell University and Virginia Tech, respectively, and a PhD in environmental engineering from the University of Michigan.

Christa Hasenkopf

Chief Executive Officer and Co-Founder
OpenAQ
Washington, District of Colombia
United States

Christa Hasenkopf is an atmospheric scientist, passionate about fighting air inequality - the unequal access to clean air to breathe across the world - and using open data and convening community to do it. She is the chief executive officer and co-founder of OpenAQ, a non-profit housing a real-time global open air quality data platform and community, created and used by scientists, software developers, journalists, and lovers of open environmental data. She is also an adjunct associate professor at Georgetown University and an adjunct professor at Johns Hopkins in the Environmental Science & Policy Program, part of the Advanced Academic Program.

Previously, Hasenkopf was the first Chief Air Pollution Advisor to the Medical Director at the U.S. Department of State. Prior to this work, she was a fellow in the Global Development Lab at USAID. Before moving to Washington, D.C., Hasenkopf conducted postdoctoral research on air pollution in Ulaanbaatar, Mongolia. With colleagues, she launched the first air quality instrument in Mongolia that shared air quality data via social media.

Hasenkopf received a PhD in atmospheric & oceanic sciences from the University of Colorado and a BSc in astronomy & astrophysics from Penn State University. She is a former Echoing Green Fellow, USAID/PEER Partner, NSF International Research Fellow, Fulbright Fellow, and corps member in Teach for America.

Laila Khodeir

Associate Professor
The British University in Egypt
Cairo
Egypt

Dr. Laila Khodeir is an associate professor of architecture and management at the British university in Egypt and Ain Shams University. She is a certified project management professional (PMP) from the PMI, a green classroom professional from the LEED Association and the principle investigator of the Interactive Sustainable Child Development Center (ISCDC) research project. She earned her undergrad from Ain Shams University in 2002. Her master's degree in 2005 focused on social sustainability and was entitle The Impact of Local Communities on Eco-lodge Design Criteria. Dr. Khodeir earned her PhD in 2010 and focused on the newly emerging discipline in Egypt of facility management. Since then, the research work of Dr. Laila has focused generally on facility management, construction project management, and the application of management as a broad term in teaching architecture. She has published more than 45 papers in peer reviewed journals and international conferences and has published three book chapters, as well as acted as a reviewer in a number of national and international journals including JOC Journal of Construction, South Africa and Ain Shams Engineering Journal, Elsevier, and Science Direct.

Dr. Laila has acted as an external examiner to master's students in Cape Peninsula University of Technology, South Africa and IUSD post graduate students in Ain Shams University in Egypt. She has shared in supervising more than 45 master's and PhD dissertations at Ain Shams University and the British University in Egypt. Dr. Laila joined the British University in Egypt (BUE) in 2014, and has been involved in teaching current courses in a variety or correlated disciplines since then including: building services and sustainable design, building construction and management, project management and architecture design, human resource and lean construction management. She is particularly interested in sustainable design, facility management, maintenance management, building performance evaluation, construction project management, risk management, quality management and control, change management practices, marketing management for construction projects, capacity management, and value engineering.

Hussam Mahmoud

George T. Abell Associate Professor in Infrastructure
Director, Structural Laboratory
Department of Civil and Environmental Engineering Colorado State University
Fort Collins, Colorado
United States

Dr. Hussam Mahmoud is an associate professor and is the George T. Abell Professor in Infrastructure in the Department of Civil Engineering at Colorado State University (CSU). He is also the director of the Structural Laboratory at CSU and the academic advisor for the ASCE Student Chapter. He is affiliated with the School of Biomedical Engineering and the School of Advanced Materials Discovery. He obtained his BSc and MSc in civil engineering from the University of Minnesota and his PhD from the University of Illinois at Urbana Champaign (UIUC). Prior to arriving at CSU, he was the manager of the NEES Earthquake Laboratory at the UIUC where he oversaw and conducted various large-scale hybrid simulations. Prior to joining UIUC, he was as a research scientist at Lehigh University where he managed and led various projects pertaining to fatigue and fracture assessment of steel structures across the U.S. through laboratory testing and structural health monitoring. Dr. Mahmoud's research program has three major thrusts including assessment of community resilience and recovery following extreme events, quantification of building damage to single and multiple hazards, and maintenance and evaluation of deteriorated infrastructure.

For the first and second thrusts, the focus is on assessment and development of resilient systems subjected to extreme single and multiple, natural and manmade hazards including blasts, fire, earthquakes, tsunamis, floods and hurricanes or a combination of such. The system level structural analyses are then utilized for spatial and temporal quantification of resilience of communities following extreme events. This is realized through modeling and representing the hazard, assessing infrastructure damage, losses, and recovery overtime, and evaluating the socio-economic consequences within a community. Moreover, hazard-agnostic models have been developed to allow for the assessment of community recovery, following economic downtime or social disruptions. The third major thrust pertains to assessment and repair of deteriorated infrastructure subjected to high and low-cycle fatigue. He has conducted various studies on fatigue evaluation of navigation structures and has performed numerous in-service evaluations of major bridges across the U.S. with successful implementation and adaptation by various specifications.

The assessment and repair strategies are then utilized in holistic life-cycle analysis frameworks to devise optimized inspection and repair intervals for managing infrastructure while minimizing the total life-cycle cost, including direct and indirect social and economic costs. Dr. Mahmoud publishes his research findings in reputable journals. He is a technical reviewer for various journals and serves on many technical committees including ASCE on Fire protection and ASCE on Multi-Hazard Mitigation and is a member of the U.S. Steel Bridge Task Force of the American Iron and Steel Institute. He is the recipient of various awards including the American Institute of Steel Construction early faculty career award, the R. J. Dexter Memorial Lecture award, and the Air Force summer faculty fellowship award.

Miriah Meyer

Associate Professor
School of Computing
University of Utah
Salt Lake City, Utah
United States

Miriah is an associate professor in the School of Computing at the University of Utah and a faculty member in the Scientific Computing and Imaging Institute. She co-directs the Visualization Design Lab, which focuses on the design of visualization systems for helping analysts make sense of complex data, as well on the development of design methods for helping visualization designers make sense of real-world problems. She obtained her Bachelor's degree in astronomy and astrophysics at Penn State University, and earned a PhD in computer science from the University of Utah. Prior to joining the faculty at Utah Miriah was a postdoctoral research fellow at Harvard University and a visiting scientist at the Broad Institute of MIT and Harvard.

Miriah is the recipient of a NSF CAREER grant, a Microsoft Research Faculty Fellowship, and a NSF/CRA Computing Innovation Fellow award. She was named a University of Utah Distinguished Alumni, both a TED Fellow and a PopTech Science Fellow, and included on MIT Technology Review's TR35 list of the top young innovators. She was also awarded an AAAS Mass Media Fellowship that landed her a stint as a science writer for the Chicago Tribune.

George Mitri

Associate Professor
Director, Land and Natural Resources program
Institute of the Environment
University of Balamand
Tripoli
Lebanon

George Mitri is an associate professor at the Department of Environmental Sciences and director of the Land and Natural Resources Program at the Institute of the Environment, University of Balamand, Lebanon. George holds a PhD in environmental bio-monitoring from the University of Trieste, Italy. He has more than 18 years of research experience in the field of environmental sciences. His research interests lie in the area of earth observation and geo-Information analysis and their applications in landcover/land-use mapping and monitoring, wildfire risk assessment and management, drought and land degradation assessment, and impact of climate change on terrestrial ecosystems. Dr. Mitri has been leading various research and development projects funded by national and international organizations. In 2008, he coordinated the development of Lebanon's national strategy for forest fire management. Most recently, he co-authored Lebanon's National Strategy for Air Quality Management. He has more than 70 publications in peer-reviewed journals, conference proceedings, and book chapters. Dr. Mitri is a certified expert reviewer of National Inventories Reports in the Land Use, Land Use Change and the Forestry sector under the United Nations Framework Convention On Climate Change (UNFCCC) and Kyoto Protocol, and member of several national and international committees and groups including the European Expert Group on Forest Fires.

Leonard Pease

Engineer
Pacific Northwest National Laboratory
Richland, Washington
United States

Professor Pease, a senior engineer at the Pacific Northwest National Laboratory (PNNL), holds academic appointments in internal medicine, chemical engineering and Asian studies. He earned a PhD from Princeton University in chemical and materials engineering and completed a post-doctorate position at the National Institute of Standards and Technology (NIST) as a National Research Council post-doctoral research associate. At PNNL, he leads, manages, and supports high priority and high visibility research, development, and deployment efforts. He has earned five awards for technical excellence at PNNL and is currently advancing research initiatives with the potential to save billions of dollars in U.S. nuclear waste processing costs.

Dr. Pease's research interests include developing novel image contrast agents to identify leukocyte diseases of the gastrointestinal tract now in clinical trials, exploring multiphase and transient turbulent jet flows to improve nuclear waste processing, and improving the algae-to-biofuel flowsheet by minimizing energy intensive harvesting unit operations. His research has been sponsored by the NSF, NIH, DOE, and multiple private foundations. He founded, secured capital, and advanced product development for two high-tech startup companies based on pioneering medical technologies from his lab, specializing in applying chemical engineering knowledge to medical challenges.

Dr. Pease has over 75 publications and intellectual property filings, and has been recognized for both research and teaching excellence, including a Silver Medal from the U.S. Department of Commerce. He is an alumnus of the 2017 China-America Frontiers of Engineering Symposium and the 5th Arab-American Frontiers of Engineering, Science and Medicine Symposium.

Wei Lee Woon

Associate Professor
Masdar Institute
Khalifa University of Science and Technology
Abu Dhabi
United Arab Emirates

Dr. Wei Lee Woon received his BEng degree in electronic engineering (Hons.) from the University of Manchester in 1997, and PhD from the Neural Computing Research Group, Aston University, Birmingham, U.K., in 2002. Upon graduation, he joined the Malaysia University of Science and Technology (MUST) as an assistant professor, where he served until 2007. He subsequently joined the Masdar Institute (now part of Khalifa University) in Abu Dhabi, United Arab Emirates. He has also held visiting positions at the Massachusetts Institute of Technology, Cambridge, and at the RIKEN Brain Science Institute, Tokyo, Japan. His research interests include the analysis of renewable energy data, text mining and deep learning. Dr. Woon is a member of the IEEE Technical Committee on Neural Networks and has advised UAE government entities on issues pertaining to the use of AI. To date, he has published over 80 times in peer reviewed journals and conferences, and these have received over a 1000 citations. His work has been covered in prominent media including Nature News and Physics World.

Speakers' Sessions

Big Data

Miriah Meyer, University of Utah, United States
Wei Lee Woon, Khalifa University, United Arab Emirates

Humans, machines and data: Understanding challenges and opportunities
Enrico Bertini, New York University, United States

Towards a unifying theory of learning and information
Ibrahim Alabdulmohsin, Saudi Aramco, Saudi Arabia

Computational social science: Using big data as a societal microscope
Kinga Makovi, NYU Abu Dhabi, United Arab Emirates

Machine learning driven biomarker discovery in the era of big data
Bobbie-Jo Webb-Robertson, Pacific Northwest National Laboratory, United States

Water Systems

Hassan Arafat, Khalifa University, United Arab Emirates
Jeremy Guest, University of Illinois at Urbana-Champaign

Sustainable reuse options of wastewater in Oman
Mahad Baawain, Sultan Qaboos University, Oman

The who, where, and (somewhat) why of the drinking water microbiome
Ameet Pinto, Northeastern University, United States

A potential collaboration with Water Research Center of Kuwait Institute for Scientific Research on innovative desalination technologies
Mansour Ahmed, Kuwait Institute for Scientific Research, Kuwait

Sustainable bioinspired water purification
Manish Kumar, Pennsylvania State University, United States

The Microbiome

Hussain Mahdi Bahbahani, Kuwait University, Kuwait
Leonard Pease, Pacific Northwest National Laboratory, United States

Unraveling interactions between the microbiome and the host immune system to decipher mechanisms of disease
Catherine Lozupone, University of Colorado, United States

Antimicrobial activity of lactic acid bacteria and antimicrobial peptides from camel milk
Rita Rahmeh, Kuwait Institute for Scientific Research, Kuwait

Functionality of the maternal microbiome
Jennifer Fettweis, Virginia Commonwealth University, United States

Pharmacomicrobiomics: How our microbiome cloud affects precision therapeutics
Ramy Karam Aziz, Cairo University, Egypt

Air Quality

Christa Hasenkopf, Open AQ, United States
George Mitri, University of Balamand, Lebanon

Global air quality: Challenges and opportunities
Christine Wiedinmyer, University of Colorado, United States

Examining the challenges in mainstreaming climate change in development plans: Lessons learned from Lebanon
Lea Kai, Ministry of the Environment, Lebanon

New high-resolution global composition forecast
Emma Knowland, National Aeronautics and Space Administration, United States

Putting air quality data to work – Opportunities and challenges of fine-grained spatial and temporal air quality information
Karim Tarraf, Hawa Dawa and Cairo University, Egypt

Air Quality Data and Awareness in Kuwait
Bader Albusairi, Fahad Al-Fadhli, and Nawaf Al-Hajri, Kuwait University

Next Generation Buildings and Infrastructure

Laila Khodeir, British University in Egypt, Egypt
Hussam Mahmoud, Colorado State University, United States

Scalable architectural visions!
Raya Ani, American Institute of Architects-Middle East, United Arab Emirates

Controlling thermal radiation for large scale energy applications
Xiaobo Yin, University of Colorado, United States

Reimagining heritage and public space in Fez, Morocco
Aziza Chaouni, University of Toronto and Aziza Chaouini Projects (Fez), Morocco

Programmable skins: A hygromorphic approach for low-cost adaptive building façades
Sherif Abdelmohsen, American University of Cairo, Egypt

NASEM Programs

NASEM Grand Challenges Scholars Program
Ruth David, National Academy of Sciences, Engineering, and Medicine, United States

The PEER program
Dalal Najib, National Academy of Sciences, Engineering, and Medicine, United States

Arab-American fellowships
Daniel Placht, National Academy of Sciences, Engineering, and Medicine, United States

KFAS and Regional Research & Funding Opportunities

KFAS as a catalyst of change
Yousef Aleneze, Collaborative Research Unit, Kuwait Foundation for the Advancement of Sciences, Kuwait
Batoul M Dawi, Research Grants, Kuwait Foundation for the Advancement of Sciences, Kuwait

Importance of international collaborations in research and innovation programs: Examples from Oman
Ali Al Shidhani, The Research Council, Oman

Big Data

Enrico Bertini

Associate Porfessor
Department of Computer Sciences and Engineering
NYU Tandon School of Engineering
Brooklyn, New York
United States
Email: enrico.bertini@nyu.edu

Enrico Bertini is an associate professor in the Department of Computer Science and Engineering at NYU Tandon School of Engineering. His research focuses on the development and empirical evaluation of interactive visual interfaces to help people solve complex problems with data. He is also the co-host of Data Stories, a popular podcast on data and data visualization

Humans, machines and data: Understanding challenges and opportunities

One of the most interesting trends of our times is our capacity to leverage data and computing to help people make progress with complex scientific, economic and societal problems. As we gather more and better data and develop more computational methods to process them, we also need to figure out how to help humans interact with them. In this talk, I am going to discuss the role humans play in computer-supported data processing, analysis and presentation. The focus will be on showing what challenges and opportunities lie ahead and why it is crucial for us to develop a better understanding of how humans can and should interact with data and data processing machines.

Ibrahim Alabdulmohsin

Lead, Advanced Analytics Group
Business Intelligence Division
Saudi Aramco
Dhahran, Saudi Arabia
Email: ibo.mohsin@gmail.com

Ibrahim Alabdulmohsin is leading the Advanced Analytics Group at the Business Intelligence Division at Saudi Aramco. His group is responsible for managing enterprise-wide implementations of big data & analytics, optimizing business intelligence infrastructures and reporting services, managing research collaborations with the academia, and piloting new technologies. He obtained his PhD in computer science at KAUST in 2017, MSc in electrical engineering at Stanford University, and BSc in computer engineering with highest distinction at the University of Nebraska, Lincoln in 2005. He has received a number of awards, including the Superior Scholarship Award from the University of Nebraska (2005), the KAUST Provost Award (2012), and the Outstanding Reviewer Award at NIPS (2016). He has authored one book and over 15 research papers. His research interest is in data science and related fields, such as machine learning, information theory, and mathematical optimization

Towards a unifying theory of learning and information

The notion of “learning from data” is closely connected to the notion of “information.” On one hand, one can only learn from data if it carries “enough information” about the target concept that one would like to learn about. On the other hand, over-fitting occurs if the learner memorizes “too much information” about the data itself. Despite this, the field of statistical learning theory, which answers when learning is successful, has been quite disconnected from the field of information theory. In this talk, I will show how the two fields can indeed be unified. I will introduce a new notion of over-fitting, called “uniform-generalization,” and show how it bridges the gap between the two fields. Unlike previous notions of over-fitting in the literature, “uniform generalization” has three equivalent characterizations: (1) statistical, (2) algorithmic, and (3) information-theoretic. I will describe why it captures the phenomenon of over-fitting is its full generality and list some of its favorable properties. After that, we will use it to establish an equivalence characterization between the Shannon channel capacity and the Vapnik-Chervonenkis dimension, which are the two most central concepts in learning theory and information theory. Finally, I will discuss some of the applications of this work for model selection and big data.

Kinga Makovi

Assistant Professor
Social Science Division
NYU Abu Dhabi
Abu Dhabi, United Arab Emirates
Email: km2537@nyu.edu

Kinga Makovi is an assistant professor in the Social Science Division at NYU Abu Dhabi focused on social research and public policy. She received her PhD in sociology from Columbia University, and also holds an MSc in mathematical economics from Corvinus University of Budapest. She has been visiting scholar at the Haas School of Business, and at the Department of Sociology at Harvard University. Her work focuses on behavioral convergence through shared cognitive templates used to navigate social situations, as well as social networks through which information is diffused and peer-influence is exerted. In her dissertation, she studied the social structural drivers of petitioning for the abolition of the slave trade in Britain in the early 1800s of Britain using archival records, computational techniques, and causal inference. Her work appeared in Social Forces, and Sociological Science.

Computational social science: Using big data as a societal microscope

Computational social science entered the social sciences as a “measurement revolution” – like the microscope, or the telescope of its time. Cellphones measure our behaviors and movements, and credit cards record our preferences through our purchases. The penetration of digital technologies allows us to access a much broader pool of individuals to answer surveys – the measurement device of the 20th century – but also to run experiments, and link these observations to various other records.

But, has the “big data revolution” delivered on its promise of new theoretical insights? As a social scientist with a deep interest in social mechanisms, trained in causal inference, I tend to think that we understand social (or any) phenomena when we are able to intervene in it, and foresee the outcomes of our interventions. On the surface, it looks like I would be interested in the accuracy of predictions, but in fact, I am interested in human behavior and actionable change in it. I will describe some strategies to “mine” such actionable change from data – strategies that differ from the toolkit of machine learning, and related methods. First – using large scale experiments both in the field, as well as using the crowed sourced platforms combined with other data, either on the context in which individuals are embedded in, or “meta data” that measures hard-to-access aspects of behavior helps us uncover why people act the way they do. In the context of contemporary American society I demonstrate that there is ample diversity in discrimination, and suggest that this helps us design better interventions to counteract it. Second – using linkages of large-scale administrative data sources helps us establish previously unseen social facts, for instance variation in the level of discrimination against racial minorities in the United States by the police.

Third – making big data small for targeted comparisons and using techniques of causal inference are also tools to help us make sound claims about the social world. To demonstrate these tools at work, we look at population level data on the German labor market, from which we construct the occupational networks of individuals as they move through firms through their careers in Berlin for a 3-decade period. With these data we investigate if women indeed use their networks differently compared to men, and the benefits of behaving in the same way.

Bobbie-Jo Webb-Robertson

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Dr. Webb-Robertson is currently the technical group manager of the Applied Statistics and Computational Modeling group, as well as leading a research portfolio focused on the development and application of advanced statistical methods for mass spectrometry-based omics analyses. Her research interests includes the development of statistical inference models, largely machine learning, focused on data integration with application to diverse biomarker discovery problems. Dr. Webb-Robertson has a BA in mathematics from Eastern Oregon University, an MSC in statistics and operations research, and a PhD in decision sciences and engineering systems from Rensselaer Polytechnic Institute. She is an experienced leader who is passionate about serving and leading teams and focusing research on continually improving methodologies and algorithms to deliver high-quality technical results and create compelling stories from data. She is a highly accomplished publisher with over 100 publications; full publication list on Google Scholar (https://bit.ly/2s2Wh8Q).

Machine learning driven biomarker discovery in the era of big data

Machine learning is a broad term to describe a large class of computational models that are focused on extracting knowledge from data. Machine learning methods can tackle multiple big data challenges, such as dimension reduction, pattern recognition, estimation or classification. Thus, machine learning has become a necessity in the analysis of big data for many domains. The goals of various analyses of big data, and consequently the output of machine learning, are numerous and are driven by the domain. In many cases, the goal is to generalize to new data with the purpose of classifying previously unseen data not used in the training of the model into a category. For example, your email program is most likely using a machine learning model to determine if a new email is Spam. The how and why it makes the decision are usually not of interest to the typical email user. However, in many scientific application areas with big data, the how and why are needed to extract information that can be used to either better understand the domain or to build lower dimensional and interpretable models that can be used in a practical setting. These methods are devised to take advantage of the scale of the data to find complex relationships between features and outcomes that can promote translational research.

A highly active domain in machine learning is the field of biomedical research. High-throughput biomedical data is being generated at an unprecedented rate as instruments become faster and cheaper, which is allowing larger and more complex cohorts to be analyzed. These large experiments offer tremendous hope to better understand underlying mechanisms of etiology. In particular, experts expect that the computational exploration and integration of this data will identify core biological drivers of disease that will enable improved diagnosis, prognosis, and treatment of complex diseases. These molecular high-dimensional datasets are also changing the manner that scientists approach studying disease. Many scientists are moving from a paradigm of domain-driven knowledge focused on a single hypothesis-based study of a small number of biomolecules to discovery-based science that identifies systems-level changes. This presentation will cover the place of machine learning in these large-scale molecular studies, including the challenges, gaps and opportunities.

Water Systems

Mahad Said Baawain

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Dr. Mahad Said Baawain is an associate professor in the Department of Civil and Architectural Engineering at Sultan Qaboos University. He obtained his BSc in civil engineering from Sultan Qaboos University, Oman in 1998, an MSc in environmental engineering from the Imperial College, UK in 2000, and PhD in environmental engineering from the University of Alberta, Canada in 2007. His research interests cover several areas among environmental engineering and management. Dr. Baawain has a number of major research projects and consultancy services during the last ten years with a total value of around US $ 6.5 million in different areas of environmental engineering and management (water & wastewater treatment, solid waste management and air pollution modeling). Dr. Baawain has 71 international journal papers, 53 international conference, 22 technical report, and several book chapters. Dr. Baawain served as the chair of the International Association for Hydro-Environment Engineering and Research (IAHR) Middle East and North Africa (MENA) Collaborative Committee from 2011 to 2016. He also served as the director of Center for Environmental Studies and Research at Sultan Qaboos University from February 2013 to February 2016.

Sustainable reuse options of wastewater in Oman

This study aims at providing decision makers with the complete picture about the current situation of wastewater treatment effluents in different areas in Oman. It also focuses on ranking the beneficial reuse options of wastewater in Muscat. The study concentrated on six possible options for reusing the effluents from wastewater treatment plants: urbane reuse, agriculture reuse, industrial reuse, groundwater recharge, and energy generation. The guiding goal for this research work is to promote the conservation of the country's water resources by recycling treated municipal wastewater for different potential uses. This should lower demand on finite water resources; support business and growth; and introduce reliable and potentially lower cost water sources for industry in the long-term.

The study characterized the wastewater (raw and treated) from different areas though field sampling. The total number of samples exceeded 1500 samples and the number of conducted tests exceeded 35000 tests ranged between physical, chemical and biological parameters. All obtained results for water, wastewater and sludge samples showed high variation. However, the produced treated effluents have met most of regulatory limits stated by Omani Standards except some parameters such Nitrate, E coli and TSS in certain plants.

According to the conducted field analysis and available guidelines along with environmental, social and economic consideration, the following ranking for treated effluent reuse is suggested for the six options: 1) agricultural reuse, 2) urban reuse, 3) industrial reuse, 4) groundwater recharge, 5) potable reuse (indirect), and 6) power generation.

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Dr. Ameet Pinto is an environmental engineer and assistant professor in civil and environmental engineering at Northeastern University in Boston, USA. Ameet is a chemical engineer with post-graduate degrees in environmental engineering from the University of Alaska (2005) and Virginia Tech, USA (2009). Prior to joining Northeastern University in 2016, he was a lecturer/senior lecturer at the University of Glasgow where his research was supported through prestigious grants like EPSRC's Bright IDEAS Award and NSF CAREER Award. Ameet's research focuses on the application of state-of-the-art molecular and modelling tools to tailor the microbiology of drinking water systems to improve the sustainability of treatment processes and enhance the safety and security of drinking water.

The who, where, and (somewhat) why of the drinking water microbiome

Every liter of regulation compliant drinking water contains tens of millions of phylogenetically diverse microbial cells, which constitutes the complex drinking water microbiome. This drinking water microbiome migrates daily from water treatment plants into our built environment and can mediate a range of impacts – from public health risks to infrastructure damage. Managing the drinking water microbiome is not only limited to minimizing its detrimental impacts, but also extends to exploiting these microbial communities for beneficial purposes. This approach of managing the drinking water microbiome is transformative, as it shifts our focus from eliminating microbial communities in drinking water systems to exploiting them. Delivering on this outlook requires that we first systematically observe, accurately describe, and clearly elucidate fundamental mechanisms shaping microbial community in drinking water systems. This talk will highlight recent critical insights into factors regulating microbial communities at the tap across multiple drinking water systems and how these insights may be exploited by integrating with ecological and physiological theories that attempt to capture fundamental mechanisms shaping microbial communities.

Mansour Ahmed

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Dr. Mansour Ahmed is currently the acting program manager for Water Desalination Technologies Program at the Water Research Center (WRC). He obtained a bachelor's degree in mechanical engineering from Dundee University, an MSc in mechanical engineering from Glasgow University in July 2008, and his PhD in chemical engineering from Swansea University in 2012. Dr. Mansour has over 22 years' experience in research activities related to water treatment and seawater desalination technologies. His main area of expertise is the development of forward osmosis membrane desalination technologies. He has published 18 refereed journal papers and presented 23 scientific papers in international conferences and he has six patents. Dr. Ahmed has participated in many scientific conferences and workshops as well as training courses that are related to water, wastewater treatment and seawater desalination technologies.

A potential collaboration with Water Research Center of Kuwait Institute for Scientific Research on innovative desalination technologies

The State of Kuwait is facing a truly difficult challenge of supplying freshwater in a sustainable way for domestic and for the development of various activities. This is due to lack of natural resources for freshwater and the increasing population growth rate associated with urban expansion as well as increasing growth in commercial, industrial, and agricultural activities. Accordingly, desalination facilities must be rapidly expanded to alleviate the freshwater shortages and to meet the country's freshwater needs. However, conventional desalination technologies (CDT) are prohibitively expensive, energy-intensive, and not environmentally friendly process. As a result, there is a substantial need for innovative and new advanced desalination technologies to resolve challenges involving pricing, energy and environmental issues. Therefore, Water Research Center (WRC) of Kuwait Institute for Scientific Research have remarkably developed a number of promising innovative technologies for various applications, including: seawater desalination, brine concentration, salts and minerals extraction, and treatment of produced oil water, in order to bring the technology into developing competitiveness on the commercial level. The research projects under WRC offered a unique opportunity for international collaboration between KISR and the international technology developers to achieve a breakthrough in the innovative desalination technologies. These collaborative research projects provided technology solutions to global challenges and severe limitations of innovative desalination technologies such as forward osmosis (FO) technology.

The FO technology offers several technical and economic advantages over the CDT. The main benefits that could be gained from the FO system are cost savings, as well as providing higher water recovery, higher brine concentration, higher boron rejection, and reducing the desalination plant›s facility footprint. These benefits will contribute substantially to provide an opportunity for increasing the existing permeate capacity of the Ministry of Electricity and Water (MEW) desalination plants. Accordingly, WRC has adopted Forward Osmosis (FO) for desalination applications in the State of Kuwait since 2013. WRC has scaled up the research on FO technology from laboratory scale to pilot scale level by 2016 through fruitful international collaboration between WRC and process and membrane developers. WRC's future vision is to develop FO technology to successfully achieve its benefits on commercial level in Kuwait. If these advantages are successfully achieved on a commercial scale, then Kuwait and the whole Gulf region as well as the international scientific community would benefit tremendously from the outcome of this applied research.

Based on experience gained through collaborative projects, implementation of any research project through the international collaboration will be an added value to any party since it will contribute to enhance capacity building in terms of human resources and research facilities. Accordingly, this session will provide all participants a great and unique opportunity to enhance the scientific exchange and dialogue among researchers in Arab countries and the United States, thereby facilitating interactions that will promote new synergies and collaborations among participants.

Manish Kumar

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Manish Kumar is an associate professor of chemical engineering, environmental engineering (by courtesy), and biomedical engineering (by courtesy) at Penn State University. He received his bachelor's degree from the National Institute of Technology in Trichy, India in chemical engineering. He completed an MSc in environmental engineering at the University of Illinois, and then worked for approximately seven years in the consulting industry on applied research projects (lab, pilot, and full scale) on various technologies for water and wastewater treatment. Manish returned to Illinois to complete a PhD in the area of biomimetic membranes and then conducted postdoctoral research at the Harvard Medical School on the structure of water channel proteins, aquaporins. His current work focuses on adapting molecular scale ideas from biology for use in sustainable water and wastewater treatment. He has received the US National Science Foundation CAREER award and the Della and Rustom Roy award for outstanding materials research.

Sustainable bioinspired water purification

Nature presents excellent ideas for engineering solutions for several challenges facing humanity. Lack of access to clean drinking water is a challenge that has emerged around the globe with increasing pollution, uncertain weather patterns, and overdraft of freshwater sources. One approach to obtain clean water is to create innovative technologies for treating marginal water streams to make them drinkable by utilizing technologies inspired by biological systems.

This talk will first present a quick overview of bioinspired ideas that could be relevant to treatment of marginal water sources such as seawater, brackish water, polluted surface water, and recycled wastewater. It will then focus on two specific examples of such ideas currently being studied in our group. The first example will discuss the use of cationic antimicrobial peptides used by plant seeds to protect themselves from microbial attach and discuss its relevance to developing a scalable low energy filter for off-network applications. The second example, inspired by water filtration conducted by cellular membranes will describe the progress made in the area of biomimetic membranes that utilize proteins or protein mimics to create a highly efficient desalination membrane.

The Microbiome

Catherine Lozupone

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Dr. Lozupone is faculty in the Department of Medicine at the University of Colorado Anschutz Medical Campus. Her research focuses on the complex community of microorganisms that inhabit the gastrointestinal tract. She has been heavily involved in the development of popular computational tools for microbial community analysis, such as the UniFrac algorithm for comparing microbial diversity among many samples using phylogenetic information. Her substantial publication record in human microbiome research includes studies of the relationship between gut microbiome composition and age, culture, diet, obesity, and inflammatory bowel diseases. Dr. Lozupone received a BSc in biology from Villanova University, a master's degree in microbiology from Colorado State University, and a PhD in molecular biology from the University of Colorado at Boulder. She runs an active R01 funded research group that integrates complex integrative bioinformatics analysis of multi'omic data with experimental confirmation. Her lab is currently working to understand microbiome composition and function in a variety of disease contexts, with an emphasis on the interaction between the gut microbiome and local and systemic immune phenotypes in HIV-infected individuals.

Understanding the gut microbiome as an ecosystem in health and disease

The human gut hosts a complex community of bacteria, fungi, and viruses (collectively called the 'microbiome'). Advances in sequencing technology has led to an increased understanding the composition of this community in health and also how it relates to diverse diseases ranging from obesity, to heart disease and depression. Current challenges include integrating novel methods of deeply characterizing the composition and activity of microbes and the human host to generate and test mechanistic hypotheses regarding roles of microbes in disease. Insights into microbiome structure and function are also aided by viewing the microbiome from an ecological standpoint in order to devise strategies to return a microbiome that has been subjected to disturbance (e.g. by antibiotics, poor diet or disease) to a healthy state.

Rita Rahmeh

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Dr. Rita Rahmeh is an associate research scientist in the Biotechnology Program at Kuwait Institute for Scientific Research (KISR). She obtained her MSc in science and technology in 2007 and completed her PhD in biochemistry and molecular biology with the highest honor in 2010 from University of Montpellier, France. She was a postdoctoral fellow at the Institute of Functional Genomics, France for two years. She has published and presented her research in reputable international journals (10 papers). Her research interest is in the isolation and identification of microbial community present in camel milk and their association with camel health and disease. In addition, she is specialized in the purification and characterization of the antimicrobial peptides as alternatives to antibiotics and synthetic food preservatives.

Antimicrobial activity of lactic acid bacteria and antimicrobial peptides from camel milk

Camels are multipurpose domestic animals exceptionally well-adapted to long periods of drought and heat. They can survive and reproduce in harsh conditions intolerable to other domestic animals. Internationally, camels have considerable economic importance as many manufacturers of camel milk-based products are spread out worldwide. Camel milk and its byproducts are now promoted in the market for their nutritional value and health benefits. To generate an industrial interest in this milk and to develop an understanding of camel health and disease, all camel milk aspects should be investigated. Information on the microbiology of Camel milk is very limited. Thus, our work aimed to investigate raw camel milk as a source of lactic acid bacteria and antimicrobial agents. Sixty lactic acid bacteria (LAB) were isolated and genetically identified using 16S rRNA sequencing. Among the isolated LAB, twenty-eight exhibited significant antibacterial effects against a broad spectrum of pathogens causing human and animal diseases and food spoilage. Further, the ability of these LAB to produce antimicrobial peptides was evaluated. The produced antimicrobial peptides from four isolates were biochemically characterized as heat tolerant and stable at pH range (2 to 10). Altogether, the isolated LAB and their antimicrobial peptides can lead to improving human and animal health through their potential application as probiotics, natural food preservatives in the dairy industry or as feed additives.

Jennifer M. Fettweis

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Jennifer M. Fettweis, PhD, is the project director for the Vaginal Microbiome Consortium at Virginia Commonwealth University and an assistant professor in the Department of Microbiology & Immunology and the Department of Obstetrics and Gynecology. She has been a fellow in the Center for the Study of Biological Complexity since 2009. Dr. Fettweis was awarded a BA in mathematics and economics from the University of Virginia and a PhD in microbiology and immunology from Virginia Commonwealth University. She coordinates two projects funded through the NIH's Human Microbiome Project: the Vaginal Human Microbiome Project and the Multi-'Omic Microbiome Study-Pregnancy Initiative. She also founded the Research Alliance for Microbiome Science (RAMS) Registry at VCU, which houses a participant registry and a biorepository, to promote collaboration among researchers and sharing and reuse of data and samples. Her primary research interests include host-microbiome interactions in women's health with a focus on understanding how these interactions impact women's health, pregnancy outcomes and transmission of the microbiome across generations.

Functionality of the maternal microbiome

Throughout a woman's life, dramatic shifts occur in the structure and function of microbial communities that live in and on her body that coincide with hormonal and lifestyle changes. During the reproductive years, some bacterial species such as lactobacilli can protect against infections of the female reproductive tract. An imbalance in flora is conversely associated with an increased risk for acquisition and transmission of sexually transmitted infections. It's now clear that the microbiome of the female reproductive tract plays a particularly important role in maternal and neonatal health. Imbalances in bacterial communities can increase risk for infertility, spontaneous abortion and preterm birth. The maternal microbiome may also serve the evolutionary role of seeding the microbiome of her baby at birth, which may influence lifelong microbiome composition and health. Therefore, uncovering the relationship between the maternal microbiome and early infant microbiome acquisition holds global relevance across generations. We present insights into the functionality of the microbiome that have been gained from two large projects funded through the National Institutes of Health (NIH)'s Human Microbiome Project (HMP): the Vaginal Human Microbiome Project (VaHMP) and the Multi-Omic Microbiome Project Pregnancy Initiative (MOMS-PI).

Ramy Karam Aziz

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Ramy K. Aziz is currently a professor and chair of the Department of Microbiology and Immunology at the Faculty of Pharmacy-Cairo University. He earned his PhD in microbiology and immunology from the University of Tennessee Health Science Center, USA in 2005, and since then performed postdoctoral research at leading institutions including the University of Chicago, San Diego State University, and the University of California San Diego. His research interests span molecular epidemiology, systems biology of microbial pathogens, evolution and emergence microbial pathogenesis and resistance, microbial and bacteriophage genomics and metagenomics, the human microbiome and pharmacomicrobiomics. His scientific publications include a book, seven book sections, 67 articles in peer-reviewed journals, in addition to blogs and web pages oriented to transformative education and science communication. He recently received funding from the Egyptian Academy of Scientific Research and Technology to establish an Egyptian microbiome and genome center at the Faculty of Pharmacy, Cairo University. Last but not least, he received a NASEM Arab American Frontiers Fellowship to work with Dr. Atul Butte, at the University of California San Francisco in August 2018.

Pharmacomicrobiomics: How our microbiome cloud affects precision therapeutics

The Human Microbiome Project was launched over a decade ago to explore the diversity of human-associated microorganisms at multiple body sites (skin, mouth, nose, colon, and vagina) and their impact on human health. Pioneering studies highlighted the extent of intra- and inter-individual microbiome variations, and how these variations played key roles in nutrition, health, disease, and immunity. Different models were proposed to describe the human microbiome, likening it, for example, to a missing organ or a second genome. Alternatively, I propose a microbiome cloud model, which better reflects the uncertainty in defining an individual's microbiome in time and space. This cloud concept explains the difficulty in defining static core microbiomes or biome types for different individuals, and offers a dynamic model for the impact of the microbiome on precision medicine and systems pharmacology.

Recent research results are presented on microbiome alterations in hepatitis C and conjunctivitis patients, as well as the interplay between the human and surrounding environmental microbes among nurses and drug factory workers. Finally, the nascent field of pharmacomicrobiomics, or drug–microbiome interactions, is introduced and discussed in the light of the microbiome cloud model. Key examples of drugs that are dramatically affected by gut and vaginal microbes are presented. Finally, recently developed web resources and big data analysis tools are demonstrated and applied to accelerate drug-microbiome interactions in the hope of customizing therapeutic intervention, minimizing drug toxicity, and improving the therapeutic outcomes of available medicines.

Air Quality

Christine Wiedinmyer

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Dr. Christine Wiedinmyer is the Associate Director for Science at the University of Colorado Boulder's Cooperative Institute for Research in Environmental Sciences. A former scientist at the National Center for Atmospheric Research (NCAR), Dr. Wiedinmyer holds a Bachelor of Science in chemical engineering from Tulane University and a PhD in chemical engineering from the University of Texas at Austin. Dr.

Wiedinmyer's research emphasizes the identification and quantification of various emission sources and modeling the transport and fate of emitted pollutants in the atmosphere. She is the creator of the Fire INventory from NCAR (FINN) model that estimates emissions of pollutants from open burning globally; the FINN emissions estimates have been applied in numerous air quality and climate studies to evaluate their impacts. Further, Dr. Wiedinmyer is an expert in interdisciplinary research to connect her research to other areas of societal relevance, such as public health, land management, and climate. She is the recipient of the Walter Orr Roberts Lecturer for Interdisciplinary Sciences from the American Meteorological Society in 2014 "for research on biomass burning and its impact on the atmosphere and terrestrial biosphere, and bridging atmospheric science, biology, engineering, public health and other disciplines." Dr. Wiedinmyer is also a founding member and a current board member of the Earth Science Women's Network (ESWN).

Global air quality: Challenges and opportunities

Air pollution is a global problem that can harm human health, degrade environmental quality, and impact the climate system. Globally, air pollution, which includes particulate matter and ozone, is the 5th highest risk factor for public health (2nd for low and low-middle SDI countries). Air quality is also intimately connected to climate, with important feedbacks that can have immediate and long-term consequences. Reducing air pollution can be a challenging endeavor due to the fact that air pollution is made up of different components that have different sources. Particles, carbon monoxide, and ozone are all examples of air pollutants, and the concentrations of each are determined by different sources and chemistry.

Significant advances in the efforts to understand and mitigate air pollution around the world have been made in recent years. Measurement technologies have improved in important ways to identify more components of atmospheric mixtures, quantify lower concentrations, and lower instrument cost and size. Satellite observations have enabled regional and global characterization of the spatial and temporal trends in air pollutants. These advances provide complementary observations with ground- and aircraft-based in situ measurements to determine the chemical composition of the atmosphere, the sources of air pollution, and the effectiveness of mitigation efforts. Chemical transport and climate models include more processes and have higher temporal and spatial resolutions than ever before. With these various tools, the investigation of the chemistry and impacts of various air pollutants, as well as the exploration of future scenarios, has progressed significantly. However, despite the incredible successes in air quality science made in recent years, uncertainties still exist in our understanding of the sources, chemistry, transport and impact of air pollution. Therefore, there are great opportunities for more advances in the future.

This presentation will give an overview of air pollution: the sources, chemistry, and impacts on global and regional scales. Examples of new innovations that have provided the means to advance our understanding of this important issue will be highlighted. In addition, uncertainties in our current knowledge will be discussed and exciting opportunities emphasized.

Lea Kai

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Ms. Kai is the head of the Climate Change Unit at the Ministry of Environment, which is mandated to design and implement national climate change policies in Lebanon. The Unit also leads the national work on devising sectoral mitigation targets (e.g., INDC or national commitments under the Paris Agreement) and adaptation plans and implement obligations under the international climate treaties. Ms. Kai is in charge of developing and reporting Lebanon's greenhouse gas emissions in addition to producing technical studies such as climate change impacts and their economic cost on Lebanon, technology pathways assessment, emission reduction potential of sectoral strategies and increasing resilience and adaptation to most vulnerable sectors. She is also a member of the Lebanese delegation to the UNFCCC and has been negotiating the climate change agreement for 10 years. In2016, she has established the 'Lebanon Climate Act' initiative, which is the first platform in the region aiming at involving the private sector in supporting the government's efforts in combatting climate change.

Ms. Kai holds a BSc in environmental health and an MSc in environmental technology from the American University of Beirut. She is also a UNFCCC lead reviewer of national inventories of developed countries. She is currently pursuing public policy studies at the Harvard Kennedy School for Government.

Examining the challenges in mainstreaming climate change in development plans: Lessons learned from Lebanon

In recent years, there has been a growing momentum to mainstream climate change into development planning, to avoid working at cross-purposes and use resources more efficiently. It is often easier to integrate climate change adaptation and mitigation in existing policies and practices rather than creating new ones. Mainstreaming can therefore save money by making more efficient use of scarce resources, rather than building separate institutions and processes to support climate change action. Development and adaptation are acknowledged as mutually dependent strategies, and efforts to streamline climate-related concerns into the development-planning and decision-making processes are emerging around the world.

However, in the Arab region, environment including climate change is still not a priority on the political and development agenda, making the mainstreaming process difficult. Despite the projected and observed impacts of climate change in Lebanon, there is still not enough momentum to concretely include preventive, adaptive and mitigating measures into sectoral plans. Such integration is not straightforward, and limited knowledge on multi-level governance exists. In addition, when mainstreaming is successful, several barriers hinder proper implementation such as institutional and legal reforms, under –resourcing, unreliable information and lack of technical knowledge.

The intervention in the symposium will discuss the challenges in integrating climate change concepts in development planning and the opportunities that this might bring to policy makers. It will also suggest some concrete steps which may be taken in order to foster a more systematic consideration of climate change matters and to assist the achievement of the Sustainable Development Goals. Lessons learned shared in this intervention are based on real-life examples gathered through 12 years of practice in mainstreaming climate change in the Lebanese development agenda.

K. Emma Knowland

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Dr. Emma Knowland is a research scientist with Universities Space Research Association, working at NASA's Global Modeling and Assimilation Office (GMAO) since 2015. The GMAO develops GEOS, a suite of earth system models which can simulated global weather and air pollution chemistry on a full range of time and spatial scales. Here, Dr. Knowland is a leading member of the team expanding the capabilities of the GEOS model to produce a high-resolution air quality forecast. In addition, she evaluates the representation of atmospheric pollutants in other GEOS model products with particular focus on how stratospheric ozone can be transported to the surface, thereby causing surface ozone concentrations higher than air quality regulations permit.

Dr. Knowland is an atmospheric scientist; she earned her PhD at the University of Edinburgh, Scotland and her MSc and BSc (Honors) at McGill University, Montreal, Canada. Dr. Knowland has presented at national and international conferences and authored and co-authored several peer-reviewed journal articles in her field of research.

New high-resolution global composition forecast

Every day, weather prediction models communicate with satellites, weather balloons, and surface monitoring networks, ingesting millions of observations to make the best possible forecast. Now, because of advances in computing and software engineering, these same weather forecasting models can be used as the foundation for forecasting air pollutants, including particulate matter, ozone and nitrogen dioxide, which have health impacts on humans and vegetation. Currently, surface air pollutant observations are sparse, leaving vast areas of the globe unobserved. Air pollutant concentrations can be inferred from satellite observations; however, overpasses may be infrequent and it is often difficult to infer the 'nose-level' concentrations that air quality managers need. Global models with state-of-the-science atmospheric chemistry equations help fill in the gaps left by observations and provide insight on future conditions.

Forecasting air quality has typically been performed at the local-scale, either for an individual city, state or country. Simulating the emission, transport, and chemical evolution of air pollutants globally and at high spatial resolution requires a powerful supercomputer, such as the one at NASA Goddard Space Flight Center, in Greenbelt, Maryland. Here, NASA's Global Modeling and Assimilation Office is using its weather forecasting model "GEOS" to develop a global, high resolution atmospheric composition forecast capable of providing air quality forecasts in near-real time. This model uses a complex atmospheric chemistry model and is run on NASA's Center for Climate Simulation supercomputer, using the computing power equivalent to 3500 personal computers. This forecast has the highest resolution of a global atmospheric composition forecast to-date, providing information at 25 km (16 miles). At each time step, the atmosphere is represented by 75 million data points, with a horizontal resolution 10 times higher than conventional global atmospheric chemistry simulations.

Air quality can vary dramatically by region and time of day. With this new global air quality forecast, we can give the best information to those making decisions regarding human health and agriculture while providing support to NASA flight campaigns and satellite missions.

Karim Tarraf

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Karim is the CEO and co-founder of Hawa Dawa. In just the first year of its founding, the tech company was recognized among others by the German Federal Ministry of Energy and Commerce, the Ministry of Transport and Digital Infrastructure, and the MIT Technology Review as one of the Top 10 Innovations in Germany and Top 35 in Europe. In Switzerland, it was named winner in the Smart Cities Vertical of the Kickstart Programme; the flagship project of the digitalswitzerland initiative.

Before founding Hawa Dawa, Karim worked for several years at the Frankfurt-UNEP Collaborating Centre for Climate and Sustainable Energy Finance. There he worked on new microfinance products to support end-user access to clean energy technologies in Southeast Asia, as well as on sustainable energy finance facilities in Turkey and Eastern Europe.

Next to his work on Hawa Dawa, Karim is also a startup mentor at the FEPS Incubation Center of Cairo University, as well as a frequent participant of expert meetings on issues like climate change, short-lived climate pollutants and smart cities. Karim is pursuing a Master's of Science in technology-oriented management from the Technical University Munich.

Putting air quality data to work – opportunities and challenges of fine-grained spatial and temporal air quality information.

In the 9th century A.D. a Persian physician and polymath by the name of Ar-Razi lived in Baghdad. He is considered now to be one of the most important figures in the history of medicine of his time. He was asked to choose the right spot for building Baghdad's main hospital. His first step was to have pieces of fresh meat placed at various parts of the city of Baghdad to determine the best location. He chose the place where the meat remained freshest, and thus, the ambient pollution was lowest. Almost one millennium later a mining tradition included the use of canaries in coal mines to detect toxic air quality before it could harm human miners.

The notion of air quality data-based decision making in health management, city and traffic planning is not new, rather has been applied throughout history. What is new is that in no other period in human history have technological advancements been shaping the way we do things more rapidly than today. It is estimated that by 2020 more than 31 billion devices will be connected to the internet, generating trillions of bytes of data. IoT-based technologies promise to merge both digital and physical worlds by transcending spatial and temporal barriers. To use these technologies combined with information from satellites and other measurement methods to better understand urban air quality is self-evident. However, this approach does not come without its limitations: Questions on data reliability, accuracy, rights-of-use and commercial applicability arise.

This talk will discuss the opportunities and challenges of combining low-cost sensors with Earth Observations in predicting comprehensive air quality information in urban centers. It will also demonstrate practical use-cases for the commercial use of air quality data. Finally, the talk will present an outlook for future developments in this field and demonstrate ways in which collaboration could shape the future of Environmental IoT (EIOT).

Bader H. Albusairi

Director of Engineering Training and Alumni Center
Chemical Engineering Department
College of Petroleum and Engineering
Kuwait University
Kuwait

Currently, Dr. Albusairi is an assistant professor in Chemical Engineering at Kuwait University. Also, he is the director of the Engineering Training and Alumni Office (ETAC) at the College of Engineering and Petroleum. He was born in 1974 at Al-Qadsia area in the Sate of Kuwait. He got his High school degree at 1991 with 94.6% GPA, B. Sc. In Chemical Engineering at 1996 from Kuwait University, M. Sc. From Lehigh University in Pennsylvania – USA at 1999 and his Ph.D. from Lehigh University at March 2004. In 2011 he was appointed as the director of the Assessment Office at the college of engineering during ABET visit until 2015, after that he was appointed as the director of the Guidance and Counseling Student Office in the college from 2015 to 2017 where it was appointed as the director of ETAC.

Dr. Albusairi has taught more than 10 academic courses in the undergraduate and graduate levels in chemical engineering; especially in his specific specialty of heat and mass transfer or in his research interest of mathematical modeling and simulation.

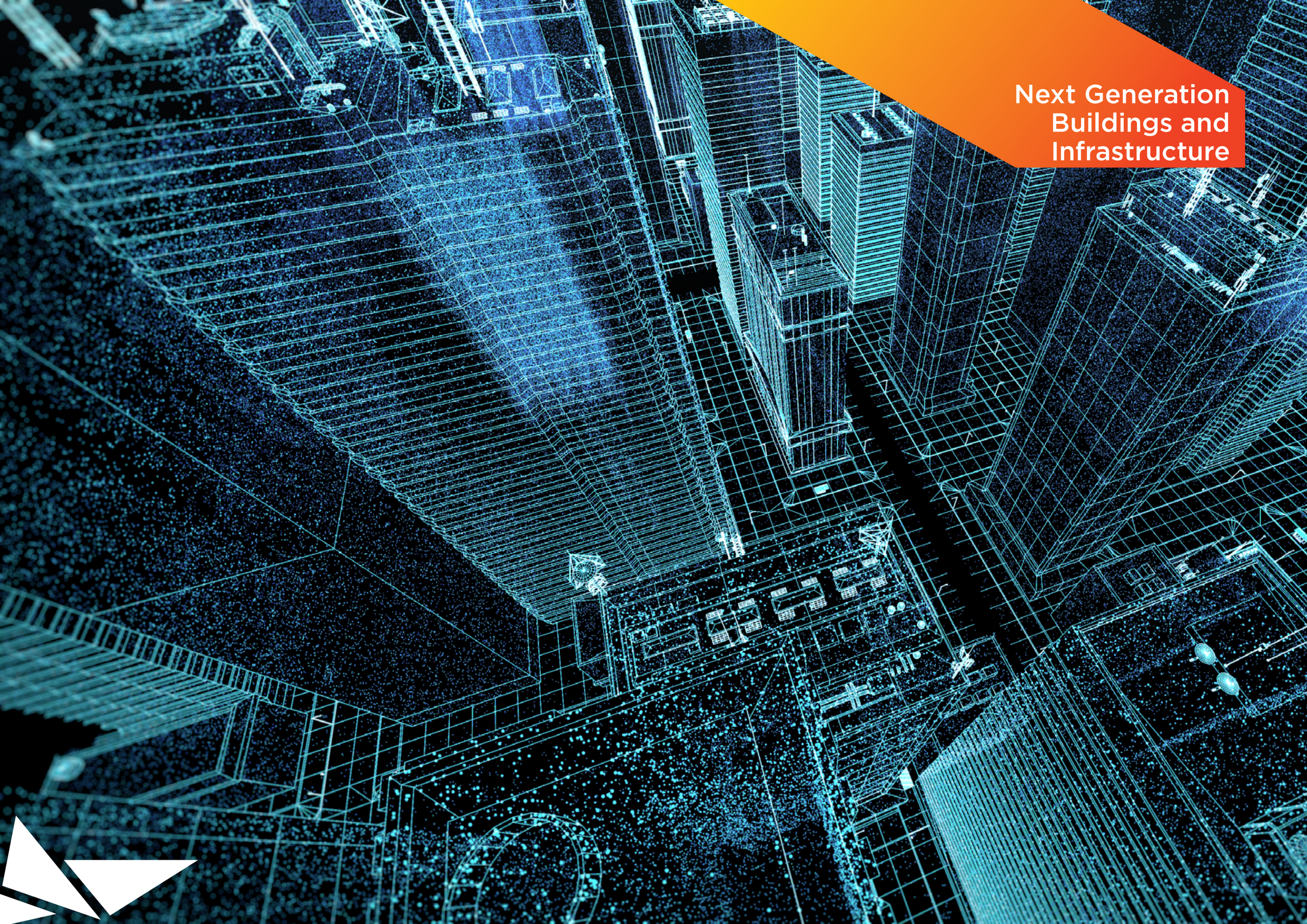
Dr. Albusairi has three main research pathways which are inter-related. These three pathways are modeling and simulation of processes and transport phenomena, polymers and degradable polymers with modeling their rheological properties, environmental issues in engineering such as pollutant dispersion modeling, recycling waste materials to have valuable products. During his job at KU, he supervises more than 15 students in the master›s degree as either supervisor or co-supervisor in the field of his research interest.

Air quality data and awareness in Kuwait

Poor air quality has become a critical environmental, economic, and health problem around the world as industrial growth and economic development have caused massive increases in air pollutants. Determining the quality of the breathed air indoors is essential for good health and productivity even in work places. Air quality forecasts and indexes are also important public communication tools. They can help people plan activities to avoid exercise and strenuous work outside when the pollution is high, and help hospitals prepare accordingly for a potential increase of patients with cardiovascular and respiratory complications.

The main objective of the presented study is to identifying pollution sources and patterns, empowering people to protect their health and raising awareness about air quality in Kuwait.

This study provides the training around 1000 No's of students from schools & universities and 500 No's of citizens on the full functionality of Air Quality monitoring devices; especially air visual device. This device provide AQI, CO2 level, humidity, 2.5 pm level, and temperature. It has many functions to increase the awareness, where it can be transmitted the information by several means to the public. Also, it is a good platform for the researcher to collect data about air quality indoor and outdoor in a simple and cheap way. These data would help in various scientific researches.



Next Generation Buildings and Infrastructure

Raya Ani

Founder, Design Director RAW-NYC Architects
2017 President, American Institute of Architects- Middle East Region
Abu Dhabi, United Arab Emirates
Email: raya@raw-nyc.com

Raya Ani an award winning architect and urban designer with 25 years of experience having worked in Baghdad, Germany, Boston, New York and Dubai. In 2015, 2016 and 2017, she was named one of the top most powerful architects in the Middle East. She is the 2017 president of the American Institute of Architects - ME Chapter. In 2018, she was selected as one of the most influential architects in the region by Middle East Architect.

She received her BSc in architectural engineering from Baghdad University with distinction, and an MSc in architectural studies from MIT where she was awarded the Harvard/MIT Aga Khan Scholarship. Raya Ani is a licensed architect in the State of New York and a US Green Building Council Accredited Professional.

Raya designed the first public green school in New York City and two green-certified (LEED) residential towers in Battery Park City. In 2012, she founded RAW-NYC Architects, an interdisciplinary architectural studio based in New York City and in 2014, she established the Dubai office. In 2013, she received AIA-ME honor award for her visionary work on the marshes of southern Iraq as well as a merit award for her design of the Aspire Sports Complex in Qatar. In 2014, her Aspire Sports Complex project received the Leisure Project of the Year Award by Middle East Architect. In 2016, she was selected as one of five inspiring personalities in the world by Black Tomato Travel and Cadillac. In 2016, Raya was shortlisted from a list of 43 leading women architects in New York to enter an international design competition to convert a women's prison to an international hub for women's empowerment. She led RAW-NYC team for Liberland to design a masterplan for a micro-nation where her vision won the first place and was widely published.

Scalable architectural visions!

Rapid population growth, strained resources and the urgency to preserve natural lands have pushed architects to consider sustainable living solutions. Buildings and environments have become visions of complete ecosystems on earth and their requirement to be smart and responsive to environmental and external stimuli has become essential. Smart buildings incorporate parametric design in conjunction with engineering to ensure building performance, efficiency, and aesthetics while still embracing a holistic sustainable approach. Our urban landscape and daily lifestyle is demanding smart solutions without compromising on the spirit of a space or an environment. This evolution could redefine what habitable spaces could mean to us in the near future.

In her presentation, Raya Ani will present two projects she designed as part of her practice / research work. She introduces visions that are ambitious yet achievable, scalable and useable in different conditions / contexts. The underlying principle behind these two projects is a holistic intelligent approach to design as part of a context whether the project is a master plan, an architectural building or a mixed-use project and whether it is a vertical or a horizontal development.

Xiaobo Yin

Bruce S. Anderson Associate Professor of Materials Sciences and Engineering and Mechanical Engineering
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Dr. Xiaobo Yin received his PhD from Stanford University in 2008 and is currently the Bruce S. Anderson Associate Professor of Materials Sciences and Engineering and Mechanical Engineering at the University of Colorado Boulder. His research focuses on nanostructured optical materials including photonic crystals and metamaterials, radiative heat transfer, high temperature materials, and scalable manufacturing. He is a recipient of the 2015 DARPA Young Faculty Award, the 2017 Moore Inventor Fellowships, and the 2017 Kavli Foundation Early Career Lectureship of Materials Science. He has authored and co-authored more than 80 journal publications with greater than 10,000 citations. His works have been featured on numerous media outlets including Nature, Science, Physics Today, Scientific American, the Economists, and Forbes. His recent work on passive radiative cooling was named as one of the top 10 breakthroughs of year 2017 by Institute of Physics (IOP) Physics World and the top 10 most reviewed news by the Economists.

Controlling thermal radiation for large scale energy applications

Micro/nano-structured materials offer significantly new opportunities for high efficiency devices and systems for energy harvesting, conversion and storage. Fundamental understanding at the small scale enables us to design structures and materials with unprecedented performances. However, there is a tremendous gap between the proof-of-principle demonstration at small scale and the intrinsically large scale real-world thermal and energy systems. As one example, energy use for cooling and air conditioning is poised to increase dramatically over the next several decades driven by population, climate and economics. In this talk, I will give an overview on our research progress and, more specifically, present our recent development on thermal radiation control for large scale radiative cooling applications. We demonstrated the scalable manufactured micro-optical composites with extreme light-material interaction provides a 24/7 continuous cooling power of 110 W/m2 at no additional cost for electricity nor water.

Aziza Chaouni

Associate Professor, University of Toronto
Founding Principal, Aziza Chaouni Projects
Fez, Morocco
Email: ac@azizachaouniprojects.com

Chaouni is an associate professor of architecture at the University of Toronto, John H. Daniels Faculty of Architecture, Landscape, and Design and the founding principal of the design practice Aziza Chaouni Projects. She is the director of the Designing Ecological Tourism Research platform at the Daniels faculty. Chaouni's practice, research, and teaching focus on the integration of architecture and landscape through the implementation of sustainable design strategies in arid regions. She is the co-editor of Out of Water, Design Solutions for Arid Regions (with L. Margolis), and the author of Ecotourism, Nature Conservation and Development in Shobak, Jordan.

Chaouni's design work has been recognized with top awards for both the Global and Regional Africa and the Middle East competition from the Holcim Foundation for Sustainable Construction; the Architectural League of New York Young Architects Award; Environmental Design Research Association Great Places Award; the American Society of Landscape Architects Design Awards; the ACSA Collaboration Award among others. Her work has been published and exhibited internationally, including at the International Architecture Biennale in Rotterdam; INDEX: Design to Improve Life in Copenhagen; and the United Nations Human Settlements Programme (UN HABITAT) World Urban Forum; the Venice Architecture Biennale; and the Louisiana Museum of Modern Art in Copenhagen. Chaouni holds a Masters of Architecture with distinction from the Harvard Graduate School of Design and a Bachelor of Science with Honors in civil engineering from Columbia University.

Reimagining heritage and public space in Fez, Morocco

Aziza Chaouni Projects has been involved in two major rehabilitation projects in Fez, Morocco: the restoration of the Qarawiyine Library built by Fatima el Fihrya in the 8th century, and the Sidi Harazem Thermal Bath, Morocco's first public leisure infrastructure project after its independence, a brutalist masterpiece erected in the 1960s.

Although reflecting different periods in the city of Fez's history, both projects provide crucial public arenas for the city of Fez. By integrating the project stakeholders within all phases of the design and rehabilitation process through various tools and by initiating new programs, we extended the role of the architect to include that of citizen. Our lecture will cover strategies for integrative design and also the relationship between heritage, memory and public space in contemporary Moroccan cities.

Sherif M. Abdelmohsen

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Department of Architecture
School of Sciences and Engineering
The American University in Cairo
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Email: sherifmorad@aucegypt.edu

Sherif Abdelmohsen is an associate professor of digital media and design computing in architecture at the Department of Architecture in the American University in Cairo (AUC), Egypt. He received his PhD in architecture from Georgia Tech, USA (2011), and MSc (2004) and BSc (2000) in architectural engineering from Ain Shams University, Egypt. He participated in design computing research and teaching at Carnegie Mellon University, Georgia Tech, the British University in Egypt, the Arab Academy for Science, Technology and Maritime Transport, the Future University in Egypt, and Ain Shams University. His courses and design studios involve computational design, theories of architecture, and advanced building technology at both the undergraduate and graduate levels.

Abdelmohsen has over 40 articles, book chapters and publications in international peer-reviewed conferences and journals and served as member of scientific committees and editorial boards for several international journals and research funding agencies. His research lies in areas at the intersection of design cognition and design computing, including cognitive processes in design, qualitative methods in design research, space layout planning, responsive architecture, parametric design, digital fabrication, building information modeling (BIM), smart building management, and automated assessment of building models. His recent research involves several topics, including the development of low-cost soft adaptive façade systems using hygroscopic properties of wood, automated post-occupancy space management using BIM and GIS, and the design and fabrication of complex facades using robotic depositing and multi-point forming.

At the professional level, Abdelmohsen has participated in international competitions and in designing several architectural projects including residential buildings and towers, mixed use complexes, office buildings, museums, libraries, exhibitions, and mosques in the United Arab Emirates, Saudi Arabia, Lebanon, Italy, Germany and Egypt. He is also co-founder and managing partner at UDAAR, an international company specialized in architecture, computational design research, and smart building management solutions.

Abdelmohsen has supervised and examined 17 MSc students and five PhD students. He participated in several public talks, international exhibitions, workshops, panel sessions, and design reviews in the USA, UK, Germany, Turkey, France, Chile, Austria, Lebanon, and Egypt. He was awarded the Young Active Researcher Award for outstanding research activity (2013), the Faculty Award of Merit for best doctoral presentation (2012), and the ARCC/King Student Medal for Excellence in Architectural + Environmental Design Research (2009). He is an associate member of the American Institute of Architects (AIA), a member of the Golden Key International Honor Society, and the International Experts for Research Enrichment and Knowledge Exchange (IEREK).

Programmable skins: A hygromorphic approach for low-cost adaptive building façades

According to the US Department of Energy, buildings in the US are responsible for approximately 40% of the primary energy demand. The heating (23%), cooling (15%) and lighting (14%) of spaces are dominant energy uses, making up almost 50% of the overall energy consumption. As building skins are filters between the interior and exterior of a building, they can regulate the energy flow between these two environments. If controlled correctly, conventional shading devices can decrease the building's annual cooling load by as much as 20%. These systems however exhibit performance deficiencies and clearly demonstrate the need for adaptive building skins that respond to multiple variables including weather, context and space occupancy.

The purpose of adaptive building skins is to actively moderate the influence of weather conditions on the building's interior environment. Current adaptive skins rely on rigid body motions, complex hinges and actuation devices. These attributes are obstacles to their broader adoption in low-carbon buildings. The core idea of soft adaptive skins is that they exploit the systems' elasticity to respond to stimuli. However, designing such a skin is a challenging task due to the interaction between geometry, elasticity and environmental performance. Recent research has shifted to low cost smart materials like bilayer composites, thermal bimetals, and hygromorphic materials, where the focus is on using bio-inspired systems and material properties to address sustainable adaptive façades.

This research utilizes the hygroscopic behavior of wood as a low tech smart material with a naturally responsive mechanism that exhibits different shrinkage and expansion values when exposed to different humidity levels. Wood is known for its low environmental impact, low embodied energy, carbon impact and its ability to change volume passively under certain stimuli. Originally inspired by the Islamic Mashrabeya, the research focuses on the design and application of a material-based system that is programmed to passively sense stimuli and respond in a controlled setting in hot arid climates. Experiments are conducted to deduce the design parameters affecting wood behavior, including type of wood, moisture content, thickness, grain orientation, aspect ratio, and lamination.

These parameters are seen to collectively control the morphing behavior and response time of wood to changes in humidity. Material fabrication and design parameters are studied to encode the direction and deflection value of the programmable wood system. For a more controlled and accurate responsive behavior, a combination of these parameters is necessary to achieve any given desired response. This is demonstrated in the lamination process, where unlimited variations are conducted to test all parameters in conjunction, relying on the concept of using passive and active layers. Lamination typically uses the difference in shrinkage value for each layer to account for difference in wood response to humidity, where the active layer is responsible for motion, and the passive layer accounts for resistive behavior. The combination of hardwood and softwood is usually used in the lamination process, where hardwood acts as the active layer and softwood as the passive layer. The implementation of this concept of passive and active layers to wood allows for a passive 'programmable' shape-shifting building façade system that potentially replaces highly mechanistic digitally controlled systems.

Regional and Global Funding Opportunities

John Boright

Executive Director of International Affairs
National Academy of Sciences
Washington, DC
United States

Dr. John P. Boright is the executive director of international affairs of the US National Academies. International activities of the National Academies include cooperation with national, regional, and global groups of counterparts. A central goal of these cooperative activities is to build the capacity of the science, engineering, and medical communities to successfully engage in meeting local, national and global needs, and to inform policy making. Boright has served in several governmental positions including: deputy to the associate director for national security and international affairs, Office of Science and Technology Policy, Executive Office of the President; deputy assistant secretary for science and technology affairs, Department of State; director of the Division of International Programs, National Science Foundation; and counselor for scientific and technological affairs, U.S. Embassy in Paris. He received a BA (high honors) and PhD in physics from Cornell University.

Daniel Placht

Associate program officer
National Academy of Sciences
Washington, DC
United States

Daniel Placht is an associate program officer in the Development, Security, and, Cooperation unit of the U.S. National Academy of Sciences (NAS). He currently works on the Arab-American Frontiers and PEER programs which focus on international development and capacity building through improved access to science and technology. Before joining NAS, Daniel interned at the International Law Institute in Washington, DC as well as multiple international development NGOs in Cairo, Egypt. He holds an undergraduate degree in international affairs from Bard College in New York.

Yousef Aleneze

Program Officer- Collaborative Research Unit
Research Directorate
KFAS
Kuwait
Email: yaleneze@kfas.org.kw

Yousef Aleneze graduated with BSc in Bioinformatics from Loyola University Chicago, in which he focussed on evolutionary phylogenetics of HIV-1 to identify potential RNAi targets, before pursuing joining the Research Directorate at KFAS. Recently, he completed his MSc degree in Biotechnology from the University of Glasgow in which his thesis under the supervision of Cancer Research UK Beatson Institute and Wolfson Wohl Cancer Research Centre Institute revolved around a pre-clinical drug target validation study on primary brain cancer stem cells that were surgically resected from patients.

Batoul M. Dawi

Assistant Program Officer – Research Grants
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Batoul is a graduate of University College London, where she completed a BSc (Hons) in Neuroscience. Her dissertation investigated perturbations in glucose metabolism in the Parkinsonian brain. She has since undertaken several internships in the molecular neurosciences at prestigious laboratories around the world such as the Grundke-Iqbal Lab at the Institute of Basic Research in developmental disabilities, New York and the Reta Lila Weston Institute of Neurological Sciences, UK.

Recently, Batoul pursued her passion for science policy as a summer policy fellow at the Duke University Science & Society Institute where she drafted policy documents around Medicaid coverage for genetic testing in undiagnosed rare disease.

KFAS Programs

KFAS as a Catalyst of Change

The Kuwait Foundation for the Advancement, for the past 40 years, has been working hard at pursuing its mission in catalyzing the transformation of the country from a rentier state to a knowledge-driven economy. The Foundation promotes and incorporates science, technology and innovation (STI) within every key aspect of the Kuwaiti society. Traditionally, it has served as the primary funding agency in the country, providing grants for carefully selected scientific research proposals or other STI related programs addressing national priority areas. These have included priority health issues, such as diabetes, addressing future energy and water demands, and ensuring that the delicate environment of the State, including its ecology and habitat, are used sustainably. This has also involved establishing and funding specialized centers of excellence as subsidiaries of the Foundation, to address national challenges, such as diabetes, through research and development. The Foundation has also focused its efforts on integrating STI within the private and public sectors for the promotion of human capital development and the overall growth of the sectors, as well as advocating science through the dissemination of information through various strategic mechanisms.

A critical component of the Foundation's success in achieving its mandate and advancing STI on a national level has been the establishment of key local and international partnerships. On a national level, the Foundation has played an integral role, in not only forming partnerships with local institutions to advance its own mission but has also catalyzed the formation of collaborations between local institutions to advance STI within various organizations. On the international platform, the Foundation has continually sought and established partnerships that have served as a forum for the exchange of scientific knowledge in addressing national and global challenges, as well as enabling research and development for the mutual benefit and advancement of both Kuwaiti and foreign institutions.

Ali Al Shidhani

Director of Research Centers
The Research Council
Muscat, Oman
Email: ali.alshidhani@trc.gov.om

Dr. Ali Al Shidhani is the director of research centers at The Research Council in Oman. He manages existing research centers and leads the development of new centers. He also manages information and communication technology (ICT) research at The Research Council of Oman. His mission at work is to push the ICT research and innovation agenda forward through several programs and initiatives. Dr. Ali was a visiting researcher at City University London where he researched the topic of information security in future cities. Previously, he was a full-time assistant professor in the Department of Electrical and Computer Engineering at Sultan Qaboos University where he taught, conducted research and supervised undergraduate and postgraduate projects.

Dr. Ali developed and taught several courses in digital logic design, embedded systems design, systems design for electrical and computer engineering, computing systems and programming languages. His research interest is in wireless security and he has published 17 papers in peer-reviewed journals and international conferences in addition to a book chapter. He received B.Eng in electrical and computer engineering from Sultan Qaboos University in 2001, master's degree in IT and data communications from Queensland University of Technology, Australia in 2003. Dr. Ali received his PhD in electrical and computer engineering from the University of British Columbia, Canada in 2010. Dr. Ali is a member of several national ICT committees and has delivered numerous presentations in ICT in national and international conferences and forums. Dr. Ali is also a co-founder and investor in three ICT-based startups in Oman.

Importance of international collaborations in research and innovation programs: Examples from Oman

The Research Council (TRC) of Oman was established in 2005 to support and fund research and innovation activities in the country. TRC has launched several programs targeting wide spectrum of beneficiaries and scientific disciplines. Two of TRC's flagship programs will be highlighted in the talk; they are; Ejaad and Upgrade. Ejaad is a solution accelerator program to match industry needs to local academic research capabilities. Some industry aspirations and challenges requires skills, competencies and capabilities that might not be available locally; thus collaboration with international researchers becomes necessary to complement the missing qualities. Upgrade is a program to transform ICT graduation projects to startups. Winning projects receive seed funding, incubation and business development, in addition to international training. International exposure is important for startups for the purposes or knowledge transfer and sharing experience. In the first edition of the program, winning startups visited silicon slopes, Utah, USA. There are opportunities of collaborations between TRC and international organizations to help advance Ejaad and Upgrade programs.

Participants' Posters

Day 1

1. *Big data in materials science: Application to energy storage materials*
Donald Siegel, University of Michigan, United States

2. *Novel synthesis of nanofiltration hollow fiber membranes for toxic metal removal from wastewater*
Ramia Albakain, The University of Jordan, Jordan

3. *Compounding impacts of human-induced water stress and climate change in the MENA region*
Amir AghaKouchak, University of California, Irvine, United States

4. *Big Data: Exploring the challenges and opportunities for Kuwait's healthcare system*
Dari Alhuwail, Kuwait University, Kuwait

5. *Open water data and AIto optimize water resources management and aquatic ecosystem restoration*
Mark Tompkins, FlowWest, LLC, United States

6. *Bacterial contamination & mutagenicity of Malva parviflora grown side of Zarqa river in Jordan*
Nisreen AL-Quraan, Jordan University of Science and Technology, Jordan

7. *Climate change impacts on the built environment*
Simi Hoque, Drexel University, United States

8. *Integrated coastal zone management for the state of Kuwait: A conceptual framework*
Alanoud Al-Ragum, Kuwait Institute for Scientific Research, Kuwait

9. *Desalination of high-salinity brines: Novel energy-efficient technologies*
Ngai Yin Yip, Columbia University, United States

10. *Alternative approaches for controlling microbes: Light, nano and beyond*
Rehab Amin, Cairo University, Egypt

11. *Automated design and fabrication of customized biomedical devices*
Paul Egan, Texas Tech University, United States

12. *Hamiltonicity in complex networks*
Milica Andelic, Kuwait University, Kuwait

13. *Lessons learned from the microbiome*
Sammy Datwani, Labcyte, United States

14. *IoT and big data technologies for occupancy detection in smart buildings*
Mohamed Bakhouya, International University of Rabat, Morocco

15. *Innovative distributed electrochemical generators for next generation buildings and infrastructure*
Whitney Goldsborough Colella, Gaia Energy Research Institute, United States

16. *Approaches to achieve sustainable groundwater management in the southern shore of the Mediterranean*
Adel Zghibi, University Tunis El Manar, Tunisia

17. *Earth observations addressing key challanges*
Hesham El-Askary, Chapman University, United States

18. *Tailoring the mechanics of origami to enable large-scale deployable and adaptable infrastructure*
Evgueni Filipov, University of Michigan, United States

19. *Vacuolar sugar transporter identification in Agave americana marginata*
Dalal Albaijan, Kuwait Institute For Scientific Research, Kuwait

20. *Computational modeling to guide air quality research and environmental policy*
Fernando Garcia Menendez, North Carolina State University, United States

21. *Adsorption of heavy metals and methylene blue from wastewater onto silica alumina geopolymers*
Malyuba Abu-Daabes, Australian College of Kuwait, Kuwait

22. *Engineering advanced water purification membranes using fundamental structure/ property relationships*
Geoffrey Geise, University of Virginia, United States

23. *GIS based method for the characterization of atmospheric dust particles*
Amin Nawahda, Palestine Technical University - Kadoorie, Palestine

24. *Use of ultra high-performance concrete and copper-based superelastic alloys in columns*
Esref Gencturk, University of Southern California, United States

25. *Applying data and systems analysis to risk-based decision making*
Ellie Graeden, Talus Analytics, United States

26. *Airborne dust microbiome in Kuwait*
Nazima Habibi, Kuwait Institute for Scientific Research, Kuwait

27. *Safeguarding water infrastructure from heavy metal contaminants using novel electrochemical sensors*
Rohan Akolkar, Case Western Reserve University, United States

28. *Managing environmental big data : Using apache spark for water and air quality data*
Hicham Hajji, IAV Institute, Morocco

29. *Dust Storms in the southwestern United States: Health impacts and meteorological predictors*
James Crooks, Colorado School of Public Health, United States

30. *Nano-microbial sensors for rapid capture and detection of pathogens*
Rabeay Hassan, Zewail City For Science And Technology, Egypt

31. *Structural engineering with rocks and string*
Douglas Holmes, Boston University, United States

32. *The impact of different types of filters on the quality of drinking water in the state of Kuwait*
Abdalrahman Alsulaili, Kuwait University, Kuwait

33. *Scaling up micro- and nano-fluidics for disease diagnostics and drug manufacturing*
David Issadore, University of Pennsylvania, United States

34. *Smart city testbed for cybersecurity research*
Michail Maniatakos, New York University Abu Dhabi, United Arab Emirates

Day 2

35. *The Enve-Omics Lab: At the interface of microbial ecology with engineering and bioinformatics*
Kostas Konstantinidis, Georgia Institute of Technology, United States

36. *Infrastructure management in Kuwait: Shuwaikh Port as a case study*
Sharaf AlKheder, Kuwait University, Kuwait

37. *Effects intermittent operation of piped water distribution systems on water quality*
Emily Kumpel, University of Massachusetts Amherst, United States

38. *Photocatalytic oxidation of volatile organic compounds for indoor air purification*
Moursi Abu Bieh, Egyptian National Research Center, Egypt

39. *Harnessing water chemistry to address complex water challenges for a thirsty world*
Haizhou Liu, University of California, Riverside, United States

40. *Environmental radioactivity in food and air*
Tareq Alrefae, Kuwait University, Kuwait

41. *Designing microbial consortia with defined social interactions*
Ting Lu, University of Illinois at Urbana-Champaign, United States

42. *Modal analysis of cancer metastasis*
Bridget Martinez, Los Alamos National Laboratory, United States

43. *Spatiotemporal analysis of the Nile river microbial diversity along the Cairo metropolis*
Aymen Yassin, Cairo University, Egypt

44. *Hyperloop: Infrastructure security implications of the revolutionary transportation mode*
Mostafa Mobasher, Thornton Tomasetti, United States

45. *The co-occurrence of extreme ozone and hot temperature events and impact of the general circulation*

Kenza Khomsi, Hassan II University, Morocco
46. *Climate model shows large-scale wind and solar farms in the Sahara increase rain and vegetation*
Safa Motesharrei, University of Maryland, United States

47. *Next generation functional organic materials for environmental remediation*
Lei Fang, Texas A&M University, United States

48. *Interaction between host genome and gut microbiome in inflammatory bowel disease*
Ahmed Moustafa, American University in Cairo, Egypt

49. *Air quality insight from open source data: OpenAirLocal*
Richard Peltier, University of Massachusetts Amherst, United States

50. *Small-scale spatio-temporal statistical mapping of criteria air pollutants in Kuwait*
Alanood Alkhaled, Kuwait University, Kuwait

51. *Wireless sensors for monitoring pharmaceutical lyophilization*
Dimitrios Peroulis, Purdue University, United States

52. *Geomatics for delineation of groundwater potential zones in Medjerda watershed, Tunisia*
Fatma Trabelsi, University of Jendouba, Tunisia

53. *Data Adsorption of oxyanions on ferrihydrite studied by flow microcalorimetry and computational chemistry*
Nadine Kabengi, Georgia State University, United States

54. *Assessing the genomic diversity and selection footprints on dromedary camels using full genome sequencing and genotyping-by-sequence approaches*
Hussain Bahbahani, Kuwait University, Kuwait

55. *Modulation of virulence in the skin microbiome by botanical natural products*
Cassandra Quave, Emory University, United States

56. *Multifunctional porous polycalix[n]arenes for efficient water purification*
Dinesh Shetty, New York University Abu Dhabi, United Arab Emirates

57. *Harnessing the cold of space as a renewable resource: Radiative sky cooling*
Aaswath Raman, University of Pennsylvania, United States

58. *Exploring stochastic gene expression in the microbiome using biomimetic robots*
Warren Ruder, University of Pittsburgh, United States

59. A *new classification approach for big data security based on networks labeling*
Sahel Alouneh, German Jordanian University, Jordan

60. *Engineering human functions: Novel data analytics and instrumentation to alter swallowing and gait*
Ervin Sejdic, University of Pittsburgh, United States

61. *Effect of soil spatial variability on onshore and offshore foundations*
Mbarka Selmi, National Engineering School of Gabes, Tunisia

62. *Bioinspired design of structural and thermal materials*
Nima Rahbar, Worcester Polytechnic Institute, United States

63. *Determination of radiation sterilization dose (RSD) of bio-hazards using omics data*
Haitham Sghaier, National Center for Nuclear Sciences and Technology, Tunisia

64. Accelerating the discovery of new superhard materials via materials informatics
Taylor Sparks, University of Utah, United States

65. *Seismic peformance of structural reinforced concrete walls*

Rafik Taleb, University of Blida 1, Algeria
66. *Electrochemical nitrogen recovery from wastewater*
William Tarpeh, Stanford University, United States

67. *Gamma radiation induced degradation of some dyes in aqueous solutions*
Haikel Jelassi, National Centre for Nuclear Sciences and Technologies, Tunisia

68. *Microbial community engineering for clean water, renewable energy, and resource recovery*
George Wells, Northwestern University, United States

69. *Impact of infection and treatment on epigenetic profiles of malarial children in Burkina Faso*
Dareen Almojil, New York University Abu Dhabi, United Arab Emirates

Moursi Abu Bieh

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Dr. Abu Bieh is a researcher in the Photo Chemistry Department of the Egyptian National Research Center. He obtained his PhD in photocatalysis and nanotechnology of nano titania and worked formerly as an assistant researcher in the Air Pollution Department, Environmental Research Division from 2002- 2008. There he worked on the monitoring and assessment of air pollutants and improving the quality of air under environmental protection projects funded from Environmental Protection Agency, and Polish Academy Of Science And Technology. Recently, he joined three in-house research projects that deal with the photocatalytic degradation of volatile organic compounds, and carbon dioxide photo chemical reduction by naturally occurring titania photocatalysts.

Dr. Abu Bieh is interested in semiconducting nano materials and the effects of physical and mechanical factors that can affect of photocatalyst behavior form degradation to selective chemical transformation. He is also familiar with doping and electrocatalysts support for photocatalytic air purification and self cleaning surface materials for photocatalytic degradation of indoor air pollutants like nitrous oxide and sulfur dioxide. Dr. Abu Bieh is a volunteer in multiple non-governmental organizations that are working on environmental impact assessments and scientific dissemination to the public. He delivers general lectures to preparatory, secondary, high school, and undergraduate students in his home university (Ain Shams University) in Cairo.

Poster #38

Photocatalytic oxidation of volatile organic compounds for indoor air purification.

Moursi Abu Bieh, Egyptian National Research Center, Egypt

Photocatalytic oxidation (PCO) is a promising and emerging technique in controlling indoor air contaminants, including volatile organic compounds (VOC's). It has broad air cleaning and deodorization applications in indoor environments ranging from residential and office buildings to healthcare and nursing facilities as well as spacecrafts, aircraft cabins and clean rooms in the agricultural and food industry. this study has been conducted to improve the effectiveness and performance of this technology. This include development of new configurations, energy-efficient photocatalysts and other parameters to control the process. However, preparation of thin film doped titania with graphene has been conducted under realistic room environmental conditions. One of the most recent developments in photocatalysis is the preparation of 0.5% nitrogen, boron, and fluorine co-doped titanium dioxide TiO2 that is loaded on carbon nano-tubes and Graphene nano layers, which is active under both dark and visible light conditions. As photocatalysis proves that inorganic doping enhances the photocatalytic activity towards degradation of air pollutants in the visible light spectrum of solar light. kinetic and thermodynamic studies of photo-degradation products has been performed under experimental laboratory conditions at different PH values, and versatile temperature degrees, Characterization and creativity of these doped photocatalysts have been investigated using different spectroscopic techniques (XRD, SEM, TEM). Results showed that N,F, Co-doped Titania TiO2 on graphene layers have higher photocatalytic rate of degradation. Mathematical modeling and simulation techniques were employed to assess the potential use of some of the promising systems that utilize the photocatalyst (i.e., packed bed and thin films) as well as the effect of mass transfer limitations in the degradation of acetaldehyde, one of the VOCs that can be found in offices, residential buildings and other facilities.

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Dr. Malyuba Abu-Daabes received her BSc from The University of Jordan (1998) and her PhD from the University of Cincinnati, USA (2005), both in chemical engineering. Afterwards she completed a post doc at the Georgia Institute of Technology, USA. In 2005 she joined the German Jordanian University, Jordan and served both as a department head and as a dean for the School of Applied Medical Sciences. In 2017 she joined the Australian College of Kuwait as an associate professor. Her research interest is mainly related to chemical separations and its applications in water, wastewater, and air pollution control, as well as water desalination by inorganic membranes.

Poster #21

Adsorption of heavy metals and methylene blue from wastewater onto silica alumina geopolymers

The scarcity of water resources in the MENA region is a major problem that threatens the quality of life and impacts the development and operation of the industrial sector which consumes large amounts of water. This drives to secure new conventional and non-conventional sources of water to address this shortage. A non-conventional source of water that is feasible for some industrial sectors is the treatment of their effluent wastewater and reusing it back in the operation at low cost. This option would save huge amounts of water and help save the scarce conventional sources in our countries.

In this project, geopolymers were prepared from different sources, natural (from local Jordanian clays) and synthetic, and with different composition and morphologies. They were synthesized and fully chacterized by different conventional techniques (TGA, XRD, XRF, SEM, porosimetry, and pycnometry) and custom-designed techniques (gas permeation). The synthesized geopolymers were used both in their powder (GPP) and membrane forms. Dye removal by GPP was investigated. Methylene blue (MB) isotherms were generated and modeled. The highest adsorption capacity for MB was found to be 25 mg/g for Wadi-Hafira geopolymer. In isotherm modelling studies, the Langmuir model was best fitted with the experimental date. MB kinetic studies showed that MB adsorption is fast and reach equilibrium within the first 30 minutes. The kinetic isotherms were best fitted with pseudo-second order reaction kinetic model.

The adsorption properties for several heavy metals (Pb^{+2}, Cd^{+2}, Cu^{+2}, Cr^{+3}, Ni^{+2}) were tested on the prepared geopolymers and their raw materials. The affinity of geopolymers for Pb^{+2} exceeded all other metals and was less for both Cd^{+2} and Cu^{+2}. Cr^{+3} and Ni^{+2} were not removed in the selected adsorbent dose range. Competitive adsorption of Pb^{+2}, Cd^{+2} and Cu^{+2} showed that Pb^{+2} adsorption was suppressed by the presence of Cu^{+2} and Cd^{+2} ions especially if low dose of the adsorbent is used.

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Amir AghaKouchak is an associate professor of civil and environmental engineering at the University of California, Irvine. His research focuses on natural hazards and climate extremes and crosses the boundaries between hydrology, climatology, remote sensing. His group has developed models for monitoring and assessing climatic extremes including the Global Integrated Drought Monitoring and Prediction System (GIDMaPS). Amir studies how extreme events and water availability might change in a warming climate. His research group at UC Irvine utilizes continuously growing satellite data along with ground-based observations to develop/improve integrated drought, flood and landslide modeling, prediction and decision support systems. Amir has served as the principal investigator of several research grants funded by the National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), and National Oceanic and Atmospheric Administration (NOAA). In 2017, he recipient of the 2017 AGU Hydrologic Sciences Early Career Award.

Poster #3

Compounding impacts of human-induced water stress and climate change in the MENA region

The water cycle is tightly coupled with water management and human water use behavior (e.g., water demand, infrastructure, and hydrologic alterations). Studies of climatic impact on water and the environment primarily focus on large-scale atmospheric conditions. In this study, we outline a methodological framework for assessing water availability in a changing climate, while explicitly considering anthropogenic water demand scenarios and water supply infrastructure designed to cope with climatic extremes. The framework brings a top-down and bottom-up approach to provide localized water assessment based on local available infrastructure (reservoirs, desalination plants) and projected water demands. We show that human activities and water use behavior can intensify future meteorological droughts; a notion referred to as Anthropogenic Drought. In this study, we provide a general definition of anthropogenic drought and how it can lead to water-bankruptcy. We focus on the Middle East and North Africa (MENA) countries that are currently experiencing serious water and environmental problems. Developing sustainable solutions for the current water and environmental problems require a deep understanding of the root causes of the problem and improving the water governance system. Following a discussion about the root causes, we discuss opportunities for re-establishing the balance between the natural water supply and human water needs through demand and resource management.

Rohan Akolkar

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Rohan Akolkar is presently the F. Alex Nason Professor of Chemical and Biomolecular Engineering at Case Western Reserve University. At Case, he is also an Ohio Eminent Scholar and the faculty director of the Great Lakes Energy Institute. Professor Akolkar's research spans many different areas of electrochemistry and electrochemical engineering, including electrochemical materials and devices for applications in nano-electronics, batteries, extraction or refining of metals, and sensors. His research has been recognized by the Case School of Engineering Research Award (2016), the Norman Hackerman Young Author Award of the Electrochemical Society (2004), and numerous industry awards and patents during his eight-year tenure (2005-2012) in R&D at Intel Corporation. Professor Akolkar has held memberships at reputed professional societies including the Electrochemical Society, the International Society of Electrochemistry, the Minerals, Metals and Materials Society, and the American Vacuum Society. Professor Akolkar has delivered numerous invited lectures at universities and industries around the world, and has co-instructed tutorials and workshops on electrochemistry and electrochemical engineering in Europe and Asia. Professor Akolkar holds PhD (2004) in chemical engineering from Case Western Reserve University and a Bachelor of Chemical Engineering degree (2001) from the Institute of Chemical Technology in Mumbai, India.

Poster #27

Safeguarding water infrastructure from heavy metal contaminants using novel electrochemical sensors

With deteriorating water infrastructure and pollution of water sources, access to clean drinking water has become a major challenge in rural and urban communities throughout the world. For example, corroding lead pipes used to distribute water have resulted in the undesired release of heavy metals contaminants (lead) in drinking water thereby posing significant health risks. Despite regulations in many countries setting safety limits for lead in drinking water, health experts agree that no amount of lead exposure is healthy and that long-term exposure to lead can result in irreversible physiological and cognitive deficiencies. Thus, the US National Academy of Engineering has identified access to clean water as one of the 14 grand engineering challenges of the century. This poster will present ongoing research at Case Western Reserve University aimed at developing the next-generation of electrochemical sensors capable of detecting heavy metal contaminants in water with unprecedented specificity, detection limit and tolerance. These sensors utilize recent advances in our understanding of specific electrochemical interactions between heavy metal species in water and semi-noble metal electrodes as well as advances in sensor micro-fabrication methods. In this poster, we will demonstrate how our sensors enable detection limit for lead contaminants in the 1ppb range in actual tap water samples from Cleveland, Ohio. Furthermore, these sensors are extremely low in cost, use very low power, and are portable as well as mass-deployable in the form of wireless-connected sensor networks for the continuous monitoring of individual water storage units or complex water infrastructure systems. Opportunities to assess the deployment of aforementioned electrochemical sensors to monitor water systems in households, hospitals, industries and cities in the US as well as many Arab countries will be discussed. These will help cultivate new collaborations between US and Arab institutions.

Dalal Al Baijan

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Dr. Dalal Bader Al Baijan is an associate research scientist at Kuwait Institute for Scientific Research. She has a BSc with a major in zoology and minor in microbiology and graduated from Kuwait University in 1997. She obtained her master's degree from Kuwait University with distinction, in the field of environmental science and her PhD from the University of Newcastle in 2015 studying the potential of the succulent genus Agave as a source of bioenergy from arid marginal land. Agave is an extremely drought tolerant and potentially productive plant due to the fact that it uses the CAM pathway for photosynthetic carbon assimilation.

The study involved mastering a range of sophisticated plant biochemical and molecular techniques (including Titratable acidity, CH2O analysis by HPLC and HPIC, Western Blotting, Tonoplast extraction, Enzyme assays and the monitoring of photosynthetic gas exchange). One of the highlights of her thesis was a novel in-depth study of the proteome of the vacuolar membrane in Agave with the goal of identifying sugar transporters likely to be fundamental determinants of Crassulacean Acid Metabolism. Dr. Al Baijan has 20 years of experience in her field, many of which have been at KISR, where she started her scientific career as a research associate before becoming an associate research scientist in 2015. During her tenure, she has worked closely on several projects involving salt tolerance involving mangrove plants. She has also worked on several plant tissue projects involving mangroves, native desert plants, truffles, and date palm trees. Dr. Al Baijan has conducted several in-house training courses on molecular biology techniques, and participated in several KISR summer training program for university students.

Poster #19

Vacuolar sugar transporter identification in Agave americana marginata

In leaves, mesophyll cells harbour large central vacuoles in which sugars, hydrolytic and In CAM plants, the vacuole serves as a storage reservoir for malic acid which accumulates as a consequence of dark CO2 uptake. In CAM species, an equivalent of 17% of total cell dry mass may cross the tonoplast everyday (Holtum et al., 2005). Agave species use soluble sugars to provide the substrate (PEP) for dark CO2 uptake (Black et al., 1996).

Sugar transporters represent an important checkpoint in regulating partitioning of photo-synthetically fixed carbon between supply of substrate on one hand and for nocturnal carboxylation and export for growth on the other hand (Antony and Borland, 2009).

To date, the transporters responsible for sucrose and hexose transfer across the tonoplast membrane have not been identified in Agave. The central aim was to develop a method to identify candidate vacuolar sugar transporters in Agave. The first step was to isolate a tonoplast-enriched protein fraction, exploiting as a guide the activity of two known vacuolar markers, ATPase and PPiase of leaf vesicles of Agave americana marginata, and their sensitivity to inhibition by known inhibitors. Secondly, a proteomics GeLCMSMS approach was used to analyse the tonoplast-enriched fraction with the aim of identifying vacuolar sugar transporter proteins. The focus on identifying vacuolar sugar transporters was due to the hypothesis that these play key regulatory roles in determining sugar turnover for CAM and fructan accumulation.

Results demonstrated that the combination of tonoplast proteomics alongside the interrogation of diel transcriptome data is a potentially powerful approach to identify candidate vacuolar sugar transporters in Agave.

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Dr. Ramia AlBakain holds a PhD with honor degree in analytical and bioanalytical chemistry from Université Pierre et Marie Curie (UPMC) and Ecole Supérieure de Physique et de Chimie Analytique (ESPCI), Paris, France. She has been an associate professor at the University of Jordan, Jordan, Department of Chemistry since 2012. Dr. Ramia was the recipient of L'Oréal-UNESCO "For Women in Science" Levant and Egypt Fellowships in 2015. She has received 13 additional awards and fellowships, including: 1) In June 2017, she was selected for the International Fulbright Visitor Award, USA: 2) In May 2017, she obtained the UK Academy of Medical Sciences Award; 3) In April 2017, she was chosen to participate in Erasmus+ teaching staff Mobility,Sweden; 4) In April 2017, she won the International Scientific Excellence Award, Lebanon; 5) In January 2017, She was the receipt of Chaire Joliot Award, France; 6) She was selected as a TWAS Young Affiliate (2016-2020) from the World Academy of Sciences; 7) In April 2016, she won first place in Senior Division at the 22nd International scientific Conference of LAAS, Lebanon; 8) In 2015, she was chosen for the Post-Doctorate award from the Scientific Research Fund, Jordan; and 9) In 2014, she obtained the DFG Fellowship from Germany. She has many international scientific collaborations with USA, France, Germany, Lebanon, and the UK. She has 18 publications in international journals.

Poster #2

Novel synthesis of nanofiltration hollow fiber membranes for toxic metal removal from wastewater

The lack of water has severe impacts on domestic needs, food production, and industrial productivity. Increasing anthropogenic activity has many affects on human health due to the emissions of toxic compounds. The emission of harmful substances as toxic heavy metals (Pb, Cd and Ni) and pharmaceutical residues results in serious threats to human health. Platinum group elements (PGEs) (Pt, Pd, Rh, Ru, and Ir) are also considered as wastes. Hospitals are a significant source of environmental pollution with PGEs since anticancer drugs used in chemotherapy departments and departments of dental filling contain PGEs. These compounds are released directly to municipal wastewater systems without special treatment, then, accumulate in the tissues of living organisms and thus can constitute a serious health risk.

Nowadays, nanofiltration membrane technology has gained attention in toxic heavy metal removal from wastewater due to the: high removal efficiency, low cost, and environmentally friendly. The aim of this study is to synthesize a new polymer using cheap compounds, simple method, and available instruments, and then, to prepare cross-linked hollow fiber membranes from this polymer for toxic heavy metals removal from wastewater.

Herein, for the first time, a new and cheap synthesized hollow fiber membrane was generated by mixing safe compounds to prepare the polymer. Then, the polymer solution was washed with isopropanol/water, and then dried. After that, certain amount of the new polymer was dissolved in NMP for doping process. The cross linked hollow fiber membranes can be performed by polyethylenimine. The formation of the cross linking can be confirmed using FTIR and XPS. Where, the morphology of the hollow fiber membrane was observed by SEM.

The results showed high efficient rejection of the hollow fiber membranes to heavy metals that exist in wastewater. This approved the new era of cheap, safe and simple methods for wastewater treatment.

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Dr. Alhuwail is the co-founder of the Kuwait Health Informatics Network and an Assistant Professor at the Information Science Department in the College of Computing Sciences and Engineering, Kuwait University. He co-founded the Health Informatics Unit at the Dasman Diabetes Institute and currently serves as a consultant. He is also an adjunct faculty member at the College of Medicine at the University of Dundee, supervising graduate students in health informatics. Dr. Alhuwail obtained a PhD in information systems -- health informatics, from the University of Maryland, Baltimore County and an MSc from the University of Arizona. Prior to and during his doctoral work, he spent 12 years working in industry and various labs around the world, including the Kuwaiti Ministry of Health, the Division of Clinical Informatics at BIDMC/Harvard, and the Health IT Lab at UMBC. Dr. Alhuwail is actively conducting research in health informatics and has several publications in peer-reviewed journals. His research interests are centered around the use, adoption, and implementation of health informatics applications. He's a member of relevant professional and academic societies including the International Medical Informatics Association (IMIA), the American Medical Information Association (AMIA), the Healthcare Information and Management Systems Society (HIMSS), the Institute of Electrical and Electronics Engineers (IEEE) and the Association for Computing Machinery (ACM).

Poster #4

Novel synthesis of nanofiltration hollow fiber membranes for toxic metal removal from wastewater

Historically and similarly to other industries, healthcare has been generating vast amounts of data mainly for keeping records, providing patient care, and complying with regulatory or legal requirements. Today, enormous amounts of healthcare data are under-utilized. As healthcare systems shift their traditional paper-based physical data repositories towards digital systems, an opportunity to better utilize and leverage this data becomes more attainable. The massive quantities of data, known as 'big data', hold the promise of supporting the clinicians and the healthcare system improve care quality while reducing costs. For example, considering the advances in computing power and geographic information systems, big data has various public health applications in disease surveillance and population health management. Other applications of big data in healthcare include personalized medicine, learning health systems, and high-output research. In Kuwait, the healthcare system has introduced information technology (IT) solutions in its facilities in the past two decades to improve health services and care delivery. However, little is known about the readiness and potential of leveraging big data from the disparate systems or 'data islands' in Kuwait's context. The aim of this project is to (i) uncover the pressing challenges for leveraging big data in Kuwait's healthcare system; (ii) discuss the potential opportunities for utilizing big data for healthcare applications in Kuwait; and (iii) provide recommendations and future directions for decision-makers.

Alanood Alkhaled

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Dr. Alanood Alkhaled is currently an assistant professor in the Civil Engineering Department at Kuwait University. She earned her PhD in environmental engineering from the University of Michigan – Ann Arbor in 2009. Dr. Alkhaled's PhD focused on using geostatistical tools for assessing the spatial variability, quantifying representation errors, and the gap-filling of remotely sensed atmospheric carbon dioxide. Additional research conducted by Dr. Alkhaled included using geostatistical methods to improve parameter estimation of water quality models. Currently, Dr. Alkhaled's research interests include meshless numerical methods, as well as spatio-temporal statistical methods for the modeling of urban air pollution at small spatial resolutions. Dr. Alkhaled is also interested in the applications of these models (e.g. source apportionment, risk assessment, and designing monitoring networks).

Poster #50

Small-scale spatio-temporal statistical mapping of criteria air pollutants in Kuwait

The Kuwait Environment Public Authority (EPA) operates a network of air quality monitoring stations. The main objective of this network is to monitor the concentration levels of air pollutants in Kuwait, particularly within residential areas. However, these measurements cannot capture the complete spatial variability of the concentrations of air pollutants within the residential areas.

This poster presents a preliminary investigation of the utility of using small-scale (0.5 km) statistical mapping of criteria air pollutants to evaluate the spatial representativeness of Kuwait EPA network measurements. The investigation includes spatio-temporal statistical estimation, and spatio-temporal statistical estimation supported by information from the underlying physical processes. The data used are the hourly measurements of criteria air pollutants from Kuwait EPA air quality network for the year 2010.

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Dr. Sharaf AlKheder is an associate professor of traffic/transportation engineering at the Civil Engineering Department in the College of Engineering and Petroleum of Kuwait University. He served previously as a dean and department chair at different engineering colleges in Jordan and the UAE. Dr. Alkheder has over than 35 peer reviewed international journal publications in traffic safety, transportation system analysis, human factors in traffic engineering, and highway design. He is a PI and Co-PI of many funded research projects in the field of traffic safety from different international funding agencies.

Poster #36

Infrastructure system management in Kuwait: Shuwaikh Port as a case study

The strategic location of Kuwait has significantly helped the country rely heavily on maritime trade for its economy. The main commercial port in Kuwait is Shuwaikh Port and is currently facing many challenges. These include traffic congestion on the internal roads and port's surroundings causing delays in the arrival times of trucks loaded with goods as well as delays in the return of empty containers to the port. Container storage at Shuwaikh Port is currently insufficient and has caused a significant reduction in ship traffic over the past years. This work aims to establish a logistics city to support the port of Shuwaikh, which will improve the performance of the port and attract more ships. The logistics city will also organize the flow of trucks and help in the establishment of an integrated environment to support many companies. This will increase port efficiency, trade mobility, storage capacity, competitiveness, reduce traffic congestion on the public streets by constructing special roads, reduce handling time and provide an international logistics center. This effort is expected to aid the Kuwait Ports Authority to manage the difficulties and problems facing the port utilization.

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Dareen completed her PhD in population genetics and reproductive behaviour of sharks. During her PhD and in an attempt to understand the links between animal behaviour and how it drives population structure and fitness, she gained more interest in environmental genomics. She is particularly interested in understanding how the environment contributes to the state of a disease or its susceptibility. Currently she is working on a project that investigates variation in genome-wide epigenetic profiles of children from Burkina Faso, before and during infection, and after treatment from malaria infection.

Poster #69

Impact of infection and treatment on epigenetic profiles of malarial children in Burkina Faso

Malaria is a major public health problem with 3.3 billion individuals at risk in tropical and subtropical regions of the world and an estimated 438,000 deaths in 2015. Major advances have been made in understanding the epidemiology and pathobiology of the disease. However, little is known about the genetic and epigenetic mechanisms modulating variation in host immune response against the parasite. In this project, we investigate variation in genome-wide epigenetic profiles of circulating immune cells of children from Burkina Faso before and during infection, and after treatment using more than 850,000 epigenetic markers from the Infinium MethylationEPIC BeadChip. Our results revealed major and statistically significant changes in the epigenetic profiles of children in response both to infection and treatment and the genomic regions underlying these changes - including five genes within the human Major Histocompatibility Complex (MHC). These results highlight the role epigenetic factors play in modulating response to malaria infection.

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Nisreen AL-Quraan graduated in 1998 with a Bachelor of Science degree from the Department of Biological Sciences, Yarmouk University, Jordan. She joined the graduate program in the Department of Biological sciences, Yarmouk University and received her Master of Science degree in plant biochemistry and molecular biology in 2001. After completion of her MSc, she worked as a research and teaching assistant for two years in the Department of Biological Sciences, Yarmouk University, Jordan. In May, 2004, she joined the Department of Biological Sciences, Auburn University, Alabama, USA to pursue her PhD degree in plant biochemistry and molecular biology working on the plant abiotic stress interaction and the role of GABA shunt pathway in plant stress tolerance and obtained her PhD in August, 2008. Since September 2008, Nisreen AL-Quraan has been an professor in plant biochemistry and molecular biology at Jordan University of Science and Technology, Jordan. Her research is focused on investigating the pathways that enable plants to adapt and tolerate harsh biotic and abiotic stress conditions. She is interested in using biochemical and molecular biology techniques to study and characterize the GABA shunt metabolic pathway that is activated in response to the interactions between plants and its environments.

Poster #6

Bacterial contamination & mutagenicity of Malva parviflora grown side of Zarqa river in Jordan

In this study, bacterial contamination and mutagenic potential have been investigated and evaluated in *Malva parviflora* at four sites, beginning with Kherbet Al-Samra waste water treatment plant (KSWWTP), and ending with King Tallal Dam. The results showed high contamination with different types of pathogens and high levels of coliforms such as: *Salmonella sp., Shigella sp., Bacillus cereus* and *Staphylococcus aureus*. Vegetable sample *(Malva parviflora)* collected in March from site1(Kherbet Al-Samra 1) recorded the highest total bacterial count (1089.82 x106 CFU/100ml) which was heavily contaminated by Shigella sp. and the lowest was in May from King Tallal Dam site 2 (3.79 x106 CFU/100ml). About seven types of gram negative bacteria and nine types of gram positive were isolated. Most vegetable samples tested showed mutagenic activity, and the highest activity was recorded in April from Kherbet Al-Samra 2.

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Alanoud is a civil engineer who has a main interest in coastal processes and management. She completed her PhD from the University of Southampton, in March 2015, focusing on sediment transport in tidal inlets. During her time at the Kuwait Institute for Scientific Research (KISR), she has been involved in different projects in Kuwait, such as the setting up of a numerical model to study the flushing system of the different phases of Sabah Al-Ahmad Sea City and the rehabilitation of Failaka Island marina. Her work consists of a combination of consultations, field surveys, laboratory experiments, on-the-job training, and co-supervising university students. Alanoud participated in both international and local conferences and workshops in addition to organizing seminars, her most recent was the inauguration of KISR's new marine monitoring buoy system in November 2015. Currently, Alanoud is leading a three year project with the Kuwait Environment Public Authority on establishing the Integrated Coastal Zone Management (ICZM) framework for the State of Kuwait. The project includes engaging with key stakeholders on a regular basis, updating policies and laws related to ICZM, and developing guidelines through environment impact assessment and best practices. With the increase of coastal projects in the area, the outcome of this project will be a step towards sustainable development for the country.

Poster #8

Integrated coastal zone management for the state of Kuwait: A Conceptual framework

Kuwait's coastline extends to 500 km and its territorial waters are shallow with rising temperatures and salinity. The whole Kuwaiti coastline is greatly affected by rapid, undirected development which has caused environmental and geomorphic changes. Human activities around the coast interfered with the natural hydrodynamic processes. In addition, waste, thermal, and chemical discharges released from power and desalination stations may have an adverse impact on the marine environment. The lack of clear laws, direct penalty, and regular institutional monitoring altered the natural setup of the coast. In order to have a successful coastal management scheme, both technical and organizational issues, such as environmental pollution, deconstruction of coastal habitats, lack of information and public awareness, must be addressed. Proper planning, communication, and cooperation between relevant entities are crucial in establishing Integrated Coastal Zone Management (ICZM) for sustainable development. The main objective of this stage was to collect and manage existing data to establish a baseline for ICZM. This was achieved through institutional coordination and stakeholder engagement.

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After obtaining his PhD from the University of Kansas in the United States, Tareq Alrefae moved back to his home country (Kuwait) to hold a faculty position in the Physics Department of Kuwait University. Tareq's current research is focused on environmental radiation, which involves assessment of the radiological safety of various ingested and inhaled substances. Moreover, these studies aim to establish baseline levels of radioactivity exposure to the general public. Examples of these studies include investigations of radionuclides in food items like milk, cereal, rice, seafood, palm dates, and water. Furthermore, radiation exposure from the inhalation of radionuclides in incense was studied and estimation of doses received by incense smoke inhalers was performed. To enhance the accuracy and cost-effectiveness of environmental gamma spectrometry, Tareq has developed software programs that utilize Monte Carlo methods to perform gamma spectrometry efficiency calibration. This computational approach has eliminated the need for standard calibration and reference materials, thus helping environmental radioactivity labs to save time and conserve resources.

Poster #40

Environmental radioactivity in food and air

Natural occurring radioactive matter (NORM) is the primary source of environmental radioactivity. Examples of NORM are 238U and its decay series, 232Th and its decay series, and the primordial isotope of potassium 40K. Owing to its eternal and pervasive character, NORM is typically present in air, soil, and water in different amounts and varying levels of activity. This environmental ubiquity makes human exposure to NORM inevitable.

Ingestion and inhalation are important pathways for radioactivity exposure. In other words, NORM exposure to the general public is directly related to the quantity and quality of consumed food and inhaled air. This firm relation triggered the interest of establishing a national baseline of radioactivity exposure to the general public. Such a baseline is expected to serve a as valuable tool for timeline and regional comparisons. Moreover, this baseline will allow professionals and lawmakers to set adequate regulations and guidelines that ensure radiation safety for the general public.

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Dr. Abdalrahman Alsulaili is an associate professor of civil engineering and the director of the

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Poster #32

The impact of different types of filters on the quality of drinking water in the state of Kuwait

Water filters are commonly used in most houses in Kuwait. The main use of filtered water is often for drinking and cooking activities and the reasons for using household filtration systems vary between the consumers' concerns about the quality of municipal water supply delivered to houses (tap water), or a desire to get highly purified potable water and therefore, from their point of view, a safer one. Another image for the lack of confidence in tap water is the high consumption of bottled water. Filters used in houses are different in terms of techniques, sizes, and prices. The aim of this study was to evaluate both the performance of major water filters available in Kuwaiti markets and the quality improvement by house water filters. A station in Kuwait University was built and a total of eight types of water filters were installed and tested for 10 months. In addition, water samples were collected from residential houses in Kuwait. The results showed that the ceramic and carbon filter had a lower cost, higher efficiency of electrical conductivity (4.9%), as well as higher efficiency of reducing turbidity (94%), TSS (100%), nitrate and nitrite concentration (38%) and total coliforms. On the other hand, carbon wrapped filter and ceramic filter may not be effective in improving the quality of water in Kuwait. The carbon wrapped filter for example, has the lowest efficiency in reducing TDS (6.6%), turbidity (75%), total coliforms (33%) and metals concentration compared with other types of filters. Therefore, it is not recommended to use these two types of filters in Kuwait. However, the residential water filters should be maintained, monitored and cleaned periodically to achieve better efficiency in all governates in Kuwait especially the ancient ones such as the one in Al-Jahra Governate.

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Dr. Amin received her BSc in microbiology and chemistry from the Faculty of Science, Ain Shams University, and PhD. in biological medical applications of laser science from National Institute of Laser Enhanced Sciences (NILES), Cairo University. In 2008, she joined NILES as a lecturer and was promoted to assistant professor in June 2013. She continued her contributions toward scientific research by developing an appreciation for multidisciplinary science to generate solutions to community problems that affect our lives. Her research focuses on investigating light-based technologies and bio-nano research for treating and sensing contaminants that impact water, food, and public health. Outside of her work, she has valuable publications in significant journals. She was a visiting researcher at Salzburg University, Austria (2008 and 2012), the Institute for Laser Technology in Medicine and Measurement Technique, Germany (2010), and The Wellman Center for Photomedicine, Harvard Medical School, USA (2013-2014). She awarded L›Oréal-UNESCO Pan Arab Fellows for Women in Science for her research in the field of photobiology in 2010.

Poster #10

Alternative approaches for controlling microbes: Light, nano and beyond

Microbial infection is the main cause of mortality in the world, and it is a serious public health problem. These concerns have led to major research efforts to discover alternative strategies to control microbes impacting water, food, and public health either by rapid detection or curative treatment. The current review focuses on light-based technologies and nanotechnology research. We successfully developed fluorescent boronic acid optical sensors for monitoring the bacterial growth. Moreover, a microplate assay for monitoring the microbial growth was evaluated and established. Nanomicrobiology research is gaining great importance in controlling infectious disease due to the unique properties of nanomaterials. Antimicrobial activity of some newly biosynthesized nanomaterials like curcumin, chitosan, and their metal conjugates will be presented. Although considerable technological success has been achieved in this field of bio-nano research, the environmental concerns of nanotechnology remain a great challenge. We successfully biosynthesized nanomaterials in a clean, non-toxic, and ecologically sound manner. In conclusion, light-based technology and nano research should gain considerable attention to understanding their properties and their effect on microbes for considerable application in controlling infectious disease.

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Dr. Andelic is an assistant professor at the Department of Mathematics, Kuwait University, since 2014. She graduated from Faculty of Mathematics, University of Belgrade, Serbia while she got her PhD degree from University of Aveiro, Portugal. Her fields of interest are matrix theory, combinatorics, and graph theory. She is author/co-author of 26 publications in recognized international journals. She has participated in seven research projects (two as a principal investigator). She has a wide range of collaborators from Kuwait, Portugal, Serbia and Iran. Recently she directed her research to the application of spectral graph theory to complex networks, big data, and other related areas.

Poster #12

Hamiltonicity in complex networks

We give a sufficient spectral condition for the nonexistence of Hamiltonian cycles in a complex network in terms of its largest signless laplacian eigenvalue. Under some additional assumptions our condition is necessary and sufficient.

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Mohamed Bakhouya is an associate professor at the International University of Rabat. He obtained his HDR from UHA-France in 2013 and his PhD from UTBM-France in 2005. He has more than ten years experience in participating and working in sponsored ICT projects. He was the PI of a Aalto starting grant at Aalto University-Finland (2011-2013), Co-PI (UTBM side) of two European projects, ASSET (FP7-SST, 2008-2011), and TELEFOT (FP7-ICT, 2008-2012). He spent two years as a research scientist at GWU-USA, participating and working in sponsored projects, mainly UPC and NSF CHREC.

He was also a member (UTBM side) of the EU EACEA Erasmus Mundus project TARGET I/II (2011-2015). He is currently a PI of CASANET project (CNRST, 2015-2017), Co-PI of MIGRID (USAID-PEER program, 2017-2019), PI of HELECAR (PSA OpenLAB@Maroc, 2017-2019), Co-PI of SELFSERV (VLIR-UOS, 2016-2018), and Co-PI of AFRIKATATERRE (SDA, 2017-2019). He was a reviewer of research project for ANR (France, 2011), Ministero dell' Istruzione, dell' Università e della Ricerca (Italy, 2012-2017), and for the European Commission-FP7 (2013-2015). He was EiC of IJARAS journal and also serves as a guest editor of a number of international journals, ACM TAAS, IJPD, CCPE, FGCS, and MICRO. He has published more than 100 papers in international journals, books, and conferences. His research interests include various aspects related to the design and implementation of distributed and context-aware systems using big data and CEP techniques.

Poster #14

IoT and big data technologies for occupancy detection in smart buildings

Mohamed Bakhouya, International University of Rabat, Morocco

Context-awareness in energy efficient buildings has been considered as a crucial fact for developing context-driven control approaches in which sensing and actuation tasks are performed according to the contextual changes. This could be done by including the occupants' presence, number, actions and behaviours in up-to-date context taking into account the complex interlinked elements, situations, processes, and their dynamics. However, many studies have shown that occupants' information is a major leading source of uncertainty when developing control approaches. Comprehensive and real time fine-grained occupancy information has to be, therefore, integrated in order to improve the performance of occupancy-driven control approaches. This work is towards the development of a holistic platform that combines recent IoT and big data technologies for real-time occupancy detection in smart buildings. We focus mainly in this work on occupants' presence by comparing both static and dynamic machine learning techniques using IoT and big data technologies. An open-access occupancy detection dataset was first used to assess the usefulness of the platform and the effectiveness of static machine learning strategies for data processing, especially for applications that follow the strategy aiming at storing data first and processing it later. However, many smart buildings' applications, such as HVAC and ventilation control, require online data streams processing. Therefore, a real-time machine learning algorithm was integrated into the platform and tested to show its effectiveness for this kind of applications. Experiments have been conducted for ventilation systems in our EEBLab and preliminary results show the effectiveness of this platform in detecting on-the-fly occupants' presence, which is required to either make the system ON or OFF and then activate the corresponding embedded control technique (e.g., On/Off, PID, State-Feedback).

Hussain Bahbahani

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Hussain Bahbahani has been an assistant professor of genetics at Kuwait University since 2015. He obtained his bachelor's degree in genetics from Aberdeen University, UK in 2008. This was followed by a master's degree in medical biosciences from the University of Newcastle upon Tyne, UK in 2009. In 2011, Dr. Bahbahani started his PhD degree at University of Nottingham specializing in animal population genetics. His PhD was completed in the summer of 2015 when he was appointed as an assistant professor at Kuwait University. He has contributed to several scientific publications published in peer-reviewed international journals. Dr. Bahbahani is now a director of the National Unit for Environmental Research and Services at Kuwait University and is the founder of the Unixomic group, which is specialized in training people in analyzing large data effectively using computer software that relies on writing specific codes.

Poster #54

Assessing the genomic diversity and selection footprints on dromedary camels using full genome sequencing and genotyping-by-sequence approaches

The dromedary camels *(Camelus dromedarius)* are single-humped even-toed ungulates populating the African Sahara, Arabian Peninsula and southern west Asia. Genomic studies on this species are limited to mitochondrial DNA and microsatellite data due to the lack of commercially available SNP chips. In addition to full genome sequencing, genotyping-by-sequencing (GBS) is a cost-effective approach can be used for high throughput single nucleotide polymorphisms (SNPs) genotyping. This approach can solve the ascertainment bias issue associated with the commercially available SNP chips. In this study a total of 44 dromedary camel samples from Africa (Sudan) (29 milk-producing and 15 racing camel) are genotyped using GBS approach to analyze their genomic diversity and relationship, and define genomic signatures of selection associated with their phenotypic traits. Additionally, six dromedary samples from Arabian Peninsula (four milk-producing camels from Saudi Arabia and two racing camels from Oman) with their full genome sequenced are included in the study. More than 1.1 million and 4.4 million SNPs were identified by the GBS and full genome sequence data, respectively. The dromedary samples from Arabian Peninsula show higher level of heterozygosity (0.41 ± 0.005) than the level in the African samples (0.28 ± 0.004). Both of principle component analysis and neighbor-joining tree demonstrate geographical genetic distinction in the camel samples analyzed. Based on a pooled heterozygosity (Hp) approach in sliding genomic windows, candidate genomic regions with signatures of positive selection are identified. These regions carry genes associated with different biological traits, such as skeletal muscles contraction and lipid metabolism.

Whitney Goldsborough Colella

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Dr. Whitney G. Colella, PhD, MBA, serves as president and principal research engineer of Gaia Energy Research Institute (Gaia). Dr. Colella has over 20 years of research and development experience in academia, government, and private industry in the areas of advanced energy conversion system design, operation, and control. Her areas of expertise include the thermodynamics, chemical engineering process plant design, economics, computer modeling, techno-economic analysis (TEA), life cycle assessment (LCA), and independent testing of advanced energy systems. Dr. Colella has served as a principal investigator (PI) on energy R&D projects totaling over $8 million and as a key technical contributor on energy R&D projects totaling over $20 million.

Dr. Colella spearheads computer simulation, testing, and independent analysis of novel, low-carbon energy systems to improve their thermodynamics, economics, and environmental performance. Dr. Colella develops and applies analytic approaches to understand the design and performance space of networked stationary polygenerative fuel cell power plants, electrochemical and hydrogen energy systems, distributed energy generation and storage devices, and advanced transportation systems. An aim of Dr. Colella's research is to use relatively inexpensive computer simulation to better design low-carbon energy devices so that they meet time-dependent energy demands, lower energy costs, and reduce emissions.

Poster #15

Innovative distributed electrochemical generators for next generation buildings and infrastructure

This research focuses on resolving primary bottlenecks in our global energy and water supply chains by installing distributed electrochemical generators within next generation buildings & infrastructure. Insights are shared into the engineering design, economics, and environmental impacts of these advanced energy concepts:

1. Distributed combined heat & power (CHP) fuel cell systems (FCSs) for supplying electricity, heat, & potable water directly on-site within buildings & responding in real-time to time-dependent demand for electricity, heat & water within these buildings;
2. Distributed combined cooling, heating & electric power (CCHP) FCSs for producing electricity, heat, cooling power, & potable water directly on-site within buildings;
3. Distributed poly-generative FCSs for producing electricity, heat, cooling power, transportation fuels, & potable water directly on-site within buildings;
4. The surrounding infrastructure to support these devices, including district heating & cooling loops, low voltage electrical grids, water conveyance & storage, and electrochemical separators & compressors for separating & compressing transportation fuels generated on-site.

These generators can achieve substantial energy and water savings. For example, a CCHP FCS can produce electricity at ~60% electrical efficiency (compared to the ~35% world average), and then the remaining 40% of heat energy available can be converted to cooling power with absorption chillers. The resulting overall efficiency can be higher than 100%, depending on the chiller's coefficient of performance. Also, unlike traditional power plants that waste a lot of water to cool the plants, these devices can be designed to produce excess potable water for the building's drinking water. This research work shares insights into the thermodynamics, chemical engineering design, economics, and environmental impacts of distributed electrochemical generators for use in next generation buildings and infrastructure.

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Dr. Crooks is an an environmental epidemiologist and statistician at the Colorado School of Public Health. His research addresses the health effects of air pollution with a focus on air pollution driven by climate change such as pollen, wildfire smoke, and dust storms. He is particularly interested in the health impact of complex mixtures of climate-related exposures. Before moving to Colorado in 2015, he worked for seven years as a scientist at the U.S. Environmental Protection Agency. He has a background in physics, spatial statistics, exposure science, toxicology, and genomics.

Poster #29

Dust storms in the southwestern United States: Health impacts and meteorological predictors

Dust storms are broadly expected to become more frequent over the coming century as surface temperatures increase, leading to increased evapotranspiration and desertification in some areas and potential for stronger storm systems. While the public health implications of dust storms have been studied extensively in other regions of the world including southern Europe and East Asian, little epidemiological research has been done in the United States, despite the fact that some regions of the United States experience frequent dust events. This poster will present recent advances in the study of the health impacts of dust storms in the southwestern United States, including impacts on non-accidental mortality and asthma-related Emergency Department and Urgent Care visits. This poster will also present statistical and machine learning techniques currently under development for predicting dust storms.

Sammy Datwani

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Dr. Datwani joined Labcyte Inc., in 2007 and is responsible for leading research and developments for new products in the arena of acoustic droplet ejection. His interests are in the areas of leveraging microfluidics and liquid handling for advancing precision medicine, microbiome research, cancer research, single cell applications and novel detection technologies. Dr. Datwani has over twenty years of experience directing, managing, inventing and applying cutting edge research and developments in both industry & academia. Prior to Labcyte Inc., Sammy was a senior scientist and the advanced technologies group manager at Eksigent Technologies, LLC (Danaher Corp.) where he led the technical development for an integrated high-performance liquid chromatography on a chip. From 2000 – 2003, Sammy held the position of R&D engineer in the Advanced Technology Group at Caliper Life Sciences (Perkin Elmer) and spearheaded the development of the several LabChip devices leveraging microfluidics and new technologies. Sammy holds several pending and issued patents and has co-authored more than 20 peer-reviewed publications in journals and books. Since 2011, Dr. Datwani has held an appointment as a professor in the Department of Biomedical, Chemical & Materials Engineering at San Jose State University. Recently, Dr. Datwani was inducted into the 2018 College of Fellows (COF) of the American Institute of Medical and Biological Engineers (AIMBE).

Poster #13

Lessons learned from the microbiome

The influence of gut microbiota on human health has been well documented, particularly in the case of metabolic disorders, such as type 1 and type 2 diabetes. In light of the strong association between the composition of one's microbiome and human health, researchers have begun to develop targeted therapies that restore optimal balance among microbial populations. Fecal transplantation and strain supplementation are just two of the methods that address disease from a precision medicine vantage point. For a detailed look at the state of the microbiome and its role in precision medicine, we have integrated acoustic droplet ejection workflows that highlight solutions.

An acoustic droplet ejection (ADE) platform is utilized that has the promise for providing novel solutions to deliver high throughput, combinatorial approaches that are more efficient, integrated biological and chemical analysis tools for personalized medicine and a variety of other applications. Highlighted are the physical principles of ADE and the key technologies that enable robust acoustic liquid handling operations—namely the ability to: probe the properties of the fluid; adjust in real-time to account for dynamic surface tension and viscosity variations, determine the acoustic energy required for ejection; and to impart charge on the droplet to aid in droplet transfer.

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Paul Egan is an assistant professor in mechanical engineering at Texas Tech University leading engineering design research in medicine. At ETH Zurich Paul was a postdoctoral research fellow developing complex 3D printed structures for bone fusion applications. Paul was a National Defense Science and Engineering Graduate Fellow for researching computational and cognitive-based methods for biosystem design during his mechanical engineering doctorate studies at Carnegie Mellon University. At Oklahoma State University, Paul earned a National Goldwater Scholarship and completed mechanical engineering, aerospace engineering, applied physics, and philosophy majors.

Paul›s research interests aim to apply mechanical design principles to developing biomedical solutions for engineered technologies and medicine. He has developed expertise in computational approaches for data analysis, software user interfaces, biomechanical systems modeling, and design optimization. His applications of interest include muscle, bone, and food. His lab is currently working on the challenge of using computational methods and big data to personalize 3D printed devices optimized for specific patient needs.

Poster #11

Automated design and fabrication of customized biomedical devices

Advances in 3D printing are enabling the design and fabrication of customized devices with complex structures, such as 3D printed tissue scaffolds tuned for a patient's unique physiology. Automated design and fabrication of patient-specific tissue scaffolds is challenging, due to the large volumes of patient data that must be considered while optimizing scaffold mechanical and biological performance. Here, we use a combination of mechanical and biological experiments with computational modeling to scientifically characterize how scaffold geometry relates to performance, and use findings to characterize scaffold design trade-offs using automated design algorithms.

We approach this problem by proposing diverse beam-based lattice topologies that have design parameters defining beam length and diameter. By altering topology and beam dimensions, it is possible to modulate scaffold elastic and shear moduli for specific constraints, which is particularly important across patients where scaffold size and overall geometry may vary considerably. A tissue simulation was developed to predict bone tissue growth, and validated with in vitro growth of bone tissue. Mechanical performance was assessed using finite element analysis validated with mechanical testing of 3D printed lattices. Tissue growth simulations show that scaffolds with smaller pores and higher porosity improve tissue growth rates, while mechanical simulations revealed higher beam diameters and lower porosity improve stiffness. Findings suggest lattices with 200micron beams and 50% porosity provide a balance between mechanical efficiency and fast tissue growth.

My future work plans to use patient-specific data to determine how altered geometries of bone-scaffold interfaces may influence scaffold performance. The work will use automated computational methods, supported by scientific experiments, to leverage big data describing patients to produce optimized scaffolds for improved health outcomes.

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Prof. El-Askary received his PhD in computational sciences and informatics from George Mason University in 2004. He is the 2015 recipient of the Chapman University›s elite Senior Wang-Fradkin Professorship award. In 2016, he was named as the regional coordinator on a $3 million Euro grant from the European Union's (EU) Horizon 2020. Through this work, he and the research team were able to deliver the first analytical solar atlas of Egypt. His research interests include studying extreme events, air pollution problems over mega cities due to natural and man-made effects, climate change and its impact on sea level rise and coral reefs for coastal areas. His research also includes using earth observations for water resources management, precision agriculture along the sustainable development goals and in dust storms monitoring and detection and studying their impact on anomalous chlorophyll outbreaks in the marine environment, hurricanes intensification as well as transport of microbes' causing valley fever and Kawasaki disease outbreaks. He has published over a 100 refereed research publications, conferences full paper and book chapters in these research areas and has been supported by NSF, NASA, USDA and EU. He has received the Saudi Arabia award hosted by ARADO affiliated with the League of Arab states for the best published article in environmental management among 150 articles in 2006. He is also member of the IEEE, AGU, EGU, COSPAR, and Phi Beta Delta Honor Society.

Poster #17

Earth observations addressing key challanges

Dust storms affect daily human life over a vast area of the Earth. There is a need for more accurate real-time observations of dust properties and for understanding dust triggering mechanisms, seasonal variabilities, and transport dynamics to assist mitigation of windblown dust consequences in many applications, including human health, weather, solar and wind energy systems, aviation, highway safety and urban development. Furthermore, a variable and changing climate poses questions of future concerns. Will arid land dust sources expand or contract? Will public agencies that protect or provide health, air quality, energy, air and land transportation, agriculture, and other elements of social promise and welfare be prepared to respond and adjust? Recent studies yield further evidence of the significant role of the dust cycle in the Earth's system. Dust emitted from arid regions is transported by wind for thousands of kilometers from its sources. In this path, dust alters the energy and water cycle, primarily by affecting incoming solar radiation and cloud formation. Thus, the dust cycle has substantial impact on atmospheric processes and other components of weather and climate systems. I am primarily interested in studying the interactions and ongoing processes between the Earth's various subsystems focusing on investigating the impact of natural and anthropogenic aerosols on: cloud micro-physics, hurricanes, human health and local climate. As such we used several remote sensing instruments with respect to monitoring dust storms over different regions namely, Nile Delta, Saudi Arabia, Himalayas, South Korea, Sierra Nevada and many more. Our synergistic use of recent advances in satellite technology and sophisticated modeling provides a state of the art approach in mapping dust sources, monitors airborne dust properties, and predicts dust outbreaks and their airborne pathways and concentrations in order to alert affected sectors of potential impacts.

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Dr. Fang obtained his BSc and MSc degrees from Wuhan University in China. He received his PhD diploma (2010) from Northwestern University, supervised by Nobel Laureate Sir Fraser Stoddart. Dr. Fang spent two and half years at Stanford University as a postdoctoral scholar in Professor Zhenan Bao's group. In 2013, he started his independent academic career as an assistant professor at Texas A&M University, where he leads a multidisciplinary research group studying functional organic materials with applications on multiple fronts. He received KANEKA Junior Faculty Award in 2015 and was honored as one of the ACS PMSE Young Investigators in 2017. Dr. Fang is also the recipient of NSF CAREER award in 2017, and the Polymers Young Investigator Award in 2018.

Poster #47

Next generation functional organic materials for environmental remediation

Next generation porous organic polymers are designed on the basis of highly efficient reaction and favorable topology for the formation of highly porous polymer networks. Scalable and cost-efficient synthesis of such conjugated porous polymer networks has been achieved using a pristine solution reaction of the monomer without the addition of an extra reagent or catalyst. This reaction also enabled the long-desired solution processing of such highly cross-linked materials into desirable forms such as membranes and fibers. Based on this novel chemistry, functional membranes, adsorbing materials, and thin films are developed for environmental remediation. First, highly selective, durable membranes are fabricated for selective nanofiltration of water and organic solutions to remove molecular and ionic pollutants. Second, highly porous thin films derived from macrocyclic monomers are integrated into electrical devices for sensing volatile organic compounds in the air. Overall, the unique and novel chemistry imparted tremendous advantages into these next-generation organic materials for important applications in environmental remediation.

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Evgueni Filipov is an assistant professor in the Department of Civil and Environmental Engineering at the University of Michigan, Ann Arbor. His research interests are focused on the underlying mechanics of origami-inspired deployable and reconfigurable structures. These mechanics are employed to improve stiffness, functionality, and manufacturing of the folded systems. Practical applications of thin origami inspired structures can range in discipline from micro-scale robotics and metamaterials to large-scale deployable architecture. Evgueni holds MS and PhD degrees in civil engineering from the University of Illinois at Urbana-Champaign, and a BSc from Rensselaer Polytechnic Institute. He has received the DARPA 2018 Young Faculty Award, the 2015 Cozzarelli Prize from the National Academy of Sciences, and the NSF Graduate Research Fellowship.

Poster #18

Tailoring the mechanics of origami to enable large-scale deployable and adaptable infrastructure

Deployable and adaptable origami systems are poised to make groundbreaking advances in the way infrastructure is designed, built, and operated. Imagine buildings that can self-assemble on-site, adapt daily to cut heating and cooling costs, and reconfigure themselves for reuse by future occupants. Despite the potential benefits, origami systems face fundamental barriers to practical large-scale implementation. For example, such structures are often dangerously flexible, partially unstable, difficult to actuate, and expensive to fabricate. This poster will highlight my ongoing research in trying to overcome these challenges. The overarching philosophy of my work, is to investigate and tailor the fundamental mechanics of thin folded sheets, and by doing so, to enable origami inspired structures at multiple scales and for various functions.

The poster will show three examples of current and related projects in our laboratory: (1) The development of analytical tools for simulating stiffness and elastic deformation in thin origami. These tools are geared for versatile geometric design and optimization of lightweight, stiff, and efficiently deployable structures. (2) A novel coupled origami structure that is flexible for deployment, but is substantially stiffer for any other bending or twisting deformation. This design is extended to a variety of different shapes; and physical prototypes from a few millimeters to three meters in size are demonstrated. (3) The study of buckling and stress concentrations in the thin folded sheets. We explore geometric design variations that minimize these potential sources of failure in origami structures. Finally, the poster will highlight the main unresolved research challenges in the field, including: material system design, fabrication, actuation, and life-cycle sustainability. The hope is to highlight our vision for deployable and adaptable infrastructure, and to invite discussion for future collaborations with the broader community.

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Dr. Fernando Garcia Menendez is an assistant professor in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University. He received his PhD in environmental engineering from the Georgia Institute of Technology. He completed his MSc in civil and environmental engineering from Stanford University and BSc in chemical engineering from Tecnológico de Monterrey (ITESM). Prior to joining NC State, he was a postdoctoral associate in the Center for Global Change Science and Department of Earth, Atmospheric, and Planetary Sciences at the Massachusetts Institute of Technology. He has also spent time working in industry and environmental advocacy. Dr. Garcia Menendez uses computer models to explore interdisciplinary questions related to air pollution, climate change, and environmental policy. His research is focused on developing tools based on numerical methods, uncertainty analysis, and integrated assessment modeling to simulate interactions between environmental and human systems. At NC State University, he leads a modeling group that aims to bridge the vast range of spatial and temporal scales at which these interactions occur. Current research includes efforts to simulate the effects of wildland fires on air pollution, evaluate uncertainty in projections of climate change impacts on air quality and health, and develop new computational methods for environmental modeling.

Poster #20

Computational modeling to guide air quality research and environmental policy

Air pollution is now the largest environmental contributor to global disease and mortality. However, the processes governing air quality are complex and occur over a vast extent of spatial and temporal scales. Computational systems today offer unique opportunities for cross-scale environmental modeling and data analysis. The goal of the research group I lead at North Carolina State University is to advance understanding of air quality and its role within natural and human systems. To pursue this objective, we use scientific computing to explore interdisciplinary questions related to air pollution, climate change, earth systems, and environmental policy. Our work relies on models that simulate atmospheric chemistry across a large range of scales, from urban to global and hourly to centennial. In this research, we develop tools based on numerical methods, high-performance computing, uncertainty analysis, and integrated assessment modeling. Ongoing research in my group includes efforts to develop new computational algorithms for environmental modeling, simulate the effects of wildland fires on air pollution, project climate change impacts on air quality and health, model air quality changes under evolving energy systems, and mitigate air pollution in Latin America. In these projects we work closely with U.S. and international collaborators, including researchers in the North Carolina Research Triangle region, other U.S. institutions, and universities outside the U.S. I am very interested in establishing new international research and educational partnerships and believe the Middle East and North Africa region offers exceptional opportunities to apply our scientific expertise, grow the reach of our research, and pursue high-impact collaborative projects.

Geoffrey Geise

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Geoffrey M. Geise is an assistant professor of chemical engineering at the University of Virginia. After earning a BSc degree in chemical engineering from the Pennsylvania State University in 2007, he proceeded to earn MSc (2010) and PhD (2012) degrees in chemical engineering from the University of Texas at Austin where he developed experimental techniques for measuring individual ion sorption in polymers and established a fundamental selectivity/permeability tradeoff relationship in desalination membrane materials. Subsequently, Dr. Geise joined the Penn State Institutes of Energy and the Environment and the Department of Materials Science and Engineering as a post-doctoral scholar at the Pennsylvania State University to study electric potential-driven ion transport in polymers. At the University of Virginia, his research focuses on studying the fundamentals of chemically- and electrochemically-driven small molecule transport through polymeric materials in order to engineer membranes that will address global water shortages and need for clean energy. He has received several professional and academic awards and honors including the NSF CAREER Award, 2016 Ralph E. Powe Junior Faculty award, the 2015 Young Membrane Scientist Award from the North American Membrane Society (NAMS), the New Professor Travel Award from Engineering Conferences International, and a University of Virginia Excellence in Diversity Fellowship.

Poster #22

Engineering advanced water purification membranes using fundamental structure/property relationships

Providing sustainable supplies of purified water and energy is a critical global challenge for the future, and polymer membranes will play a key role in addressing these clear and pressing global needs for water and energy. Polymer membrane-based processes dominate the desalination market, and polymer membranes are crucial components in several rapidly developing power generation and storage applications that rely on membranes to control rates of water and/or ion transport. Much remains unknown about the influence of polymer structure on intrinsic water and ion transport properties, and these relationships must be developed to design next generation desalination membrane materials. For desalination applications, polymers with simultaneously high water permeability and low salt permeability are desirable in order to prepare selective membranes that can efficiently desalinate water, and a tradeoff relationship between water/salt selectivity and water permeability suggests that attempts to prepare such materials should rely on approaches that do more than simply vary polymer free volume. One strategy is to functionalize hydrocarbon polymers with fixed charge groups that can ionize upon exposure to water, and the presence of charged groups in the polymer influences transport properties. Additionally, polymer backbone rigidity can be used to increase the selectivity properties of low water content polymers that are similar to commercially available desalination membrane polymers. This presentation discusses research aimed at further understanding fundamental structure/property relationships that govern water and ion transport in charged polymer films considered for desalination applications that can help address global needs for clean water.

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Dr. Bora Gencturk is an assistant professor in the Sonny Astani Civil and Environmental Engineering Department at the University of Southern California (USC). He obtained his PhD and MSc degrees from the University of Illinois at Urbana-Champaign and his BSc degree from Bogazici University (Istanbul, Turkey). Dr. Gencturk's research focuses on the durability and extreme event resilience of reinforced concrete structures with emphasis on application of high-performance materials. He specifically studies the degradation of cementitious materials due to environmental aging and investigates the application of higher performance materials to mitigate these issues. To date, Dr. Gencturk has been awarded $8.9M total in research funding as a PI or Co-PI. He has received both young investigator awards given by the U.S. National Science Foundation (NSF): CAREER and BRIGE. Dr. Gencturk has authored or co-authored 52 refereed journal papers, three book chapters, six research reports, and 44 conference papers. He has graduated four PhD and five MSc students (with theses). He is currently advising or co-advising two post-docs and five PhD students. Dr. Gencturk teaches courses on mechanical behavior of materials, structural dynamics and earthquake engineering, and probabilistic methods. Dr. Gencturk is a registered professional civil engineer in California.

Poster #24

Use of ultra high-performance concrete and copper-based superelastic alloys in columns

Columns are mainly axial load carrying elements that are the most critical components for the safety of various types of infrastructure including buildings and bridges in the case of an extreme event. This research presents a novel column design that employs ultra-high performance concrete (UHPC) and copper-based superelastic alloys to improve the durability and extreme event resilience of columns. UHPC has been developed with a strength 5-6 times higher than that of conventional concrete. This additional strength allows to use smaller sections and increase sustainability. More importantly, UHPC is impervious to deleterious agents, increasing the durability of columns several folds and extending the lifetime of structures to hundreds of years. Similarly, copper-based superelastic alloys allow the structure to deform and absorb energy at the same during a seismic event, with limited to no damage. These alloys overcome all of the limitations of existing Nickel-Titanium based alternatives in terms of cost, handling, and performance. A novel design for the columns has also been developed and proof tested that employs these high-performance materials in the most effective way while improving the constructability. The current materials and conventional construction approaches are approaching to their limit as the need to build taller buildings and longer span bridges is increasing at an unprecedented rate. Further, these structures need to remain serviceable with no significant deterioration for hundreds of years. Achieving these objectives with conventional materials is not feasible. The materials and techniques developed in this research are expected to transform the civil engineering design and construction practice allowing a transition to what we call as the "next generation" infrastructure with life-spans reaching to 300-500 years while remaining safe and serviceable.

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Dr. Ellie Graeden is the founder and CEO of Talus Analytics and a research affiliate of the Georgetown University Center for Global Health Science and Security. Dr. Graeden has developed extensive expertise applying complex systems analysis to the intersection of policy, science, and operations. She has led an interdisciplinary team at Talus in research and development efforts implemented at the national and international scales applying data analysis and computational modeling to practical decisions for public health implementation and emergency response. These projects have included a comprehensive assessment of the models used for emergency management for the US Federal emergency management community and an end-to-end analysis of international deliberate biological response requirements presented to the United Nations as part of the Biological Weapons Convention Meeting of Experts. Most recently, Dr. Graeden and her team have worked with CDC NCIRD to develop an integrated health care visibility and influenza response platform and with DHS Science and Technology Directorate to develop a platform to guide risk-based investments in flood resilience. Dr. Graeden earned her undergraduate in microbiology from Oregon State University and her doctorate in biology from the Massachusetts Institute of Technology (MIT).

Poster #25

Applying data and systems analysis to risk-based decision making

Risk is notoriously difficult to communicate well. Reducing the complexity inherent in risk analysis to focus on the most immediate and relevant results is critical to managing and responding effectively to disaster. Computational modeling and data analysis, whether 'Big Data' or small, generate complex results and nuanced recommendations, and the best available natural hazard data and models are not often not made readily available and meaningful to decision makers. To fill this gap, we have developed a systems analysis approach to understand the questions decision makers must address in the context of disaster, identify the information required to answer these questions, and align this information to the available data and models. Here, we describe this approach for projects applying risk assessment and decision support tools for floods, wildfire, and biological outbreaks. Systems analysis defines the gaps and requirements for the data not yet available. The gaps are filled through targeted data analysis and computational modeling, drawing from social science, the natural sciences, networking modeling, and statistical analysis. Analytical results are communicated as either static or interactive data visualizations, developed using a combination of Javascript, HTML, and D3.js, specifically designed to inform practical decisions of immediate relevance to decision makers. Examples include an end-to-end system to apply flood risk assessment to prioritization of community investments, a geospatial model of wildfire risk applied to insurance portfolio analysis, and identification of gaps in international biological response policy based on the requirements of outbreak management. Taken together, these examples demonstrate a method to make the results of complex risk analysis meaningful and practical.

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Dr. Habibi earned her PhD in 2011 Mohanlal Sukhadia University, India. She is an associate research scientist at the Kuwait Institute for Scientific Research, a national institute of scientific excellence in Kuwait. Her research interests are in the fields of molecular biology, bioinformatics, phylogenetic analysis, and conservation biology. She has published several research papers in reputed journals.

Poster #26

Airborne dust microbiome in Kuwait

Kuwait is a country with very high dust loading and the airborne dust can often have associated biological materials including microbes. Some of this biological material could be pathogenic that pose a risk on the ecosystem and public health. The microbial molecules such as endotoxins and fungal mycotoxins can trigger respiratory stress if they are adhered to inhalable dust particles. The dust is transported into and over Kuwait from remote locations via different pathways. This study established baseline concentrations and preliminary taxonomic characterization of microbes associated with different size fractions of dust. The identification of these microbes was done using metagenomic sequencing technology.

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Hicham Hajji is an associate professor at IAV Institute, Rabat, Morocco. He received a PhD (2005) and MSc (2001) in computer science from the National Institute of Applied Sciences of Lyon - INSA LYON , France in 2001. In 1999 he received an engineer degree of surveying from IAV Institute. Since 2001, he has occupied several positions inlcuding lecturer, IT consultant, and research & development engineer. He has been involved in more than 15 projects (technical and research projects) ranging from financial data warehousing, GIS projects , web mapping to big data with international and national institutions such as United Nations› UNIDO, USAID , Natixis bank, IXIS CIB, etc. His major research interests lie in big data management using scalable approaches and spatial data management. He was recently awarded the Water Innovation Fellowship from USAID and the Azure for Research Awards for ML (machine learning) from Microsoft. He is leading a research group working on applications of spatial big data management on transportation, telco, water management and forest management.

Poster #28

Managing environmental big data : Using Apache Spark for water and air quality data

From decades, handling data complexities was considered a recurrent problem often met in environmental data management areas such as water utilities, hydrology modeling, weather prediction, and air quality management. Recently, and due to the arrival of sensors and smart metering technologies, we have witnessed the emergence of a new class of complexity commonly expressed as the three V›s, velocity, variety, and volume. Those inherent properties imply a questioning of the current environment data management solutions and a rethinking of new solutions to guarantee efficiency and near real time processing. The aim of this poster is to present ongoing work on the use of the most known big data framework, Apache Spark, for two case studies: Water and Air Quality Management.

For the first case study, we will present the results of our two recently completed research projects related to water big data management (sponsored by FABRI/USAID and Microsoft Research Azure). We will focus on two developed aspects: namely a reference architecture for handling and managing smart metering water datasets and the use of recent machine learning techniques such as XGBoost in distributed environment. We will demonstrate how recent advancement in big data technologies especially the project Apache Spark can be adapted efficiently for getting insights from those datasets.

For the second case study, we will present a new big data approach for processing air quality data with netCDF format (often very large datasets) in a distributed environment. The work is done as part of an ongoing research project (Research Consortium from Paris) that we have been recently involved in. We will present our approach by describing how Spark dataframe/ dataset abstraction can be efficiently adapted to model air quality datasets and to allow for adaptive query processing.

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Dr. Rabeay Hassan is an associate professor of analytical biochemistry at Zewail City of Science and Technology. In 2011, he received his PhD in bioanalytical chemistry from Braunschweig University of Technology (Germany) after working for four-years at Helmholtz Center for Infection Research (Braunschweig). In 2013, he joined the Biosensors and Bioelectronics group, University of Technology Potsdam, Germany, as a post-doctoral research fellow. In 2014, he joined the group of Proteomics and Microbiology, UMONS in Mons, Belgium. In 2015, he was a visiting scholar at University of California, USA. He has received several scientific fellowships such as DAAD, Erasmus-Munds and American National Academy of Sciences. The major research interests of Dr. Hassan are microbial electrochemistry, electrochemical nano-sensors, and biosensors.

Poster #30

Nano-microbial sensors for rapid capture and detection of pathogens

Microbial infectious diseases remain a serious public health problem due to the fast-spreading of microbial pathogens in the environment. Since the detection of pathogens is necessary to the prevention and identification of health problems, sensitive detections are urgently needed. However, the reliable, sensitive and the rapid assays are not yet readily accessible. Microbial sensors and biosensors are becoming an essential part of biological assays. The big challenge is the level of sensitivity and specificity of the electrochemical assays is not sufficient. Interestingly, nano-materials have the capacity to improve the stability, minimizing of sensor's surface fouling, and increasing sensitivity and selectivity. These unique properties make them extremely attractive sensing elements for optimization of the nano-microbial sensors. Thus, nanomaterial-based sensing approaches that incorporate different types of nanoparticles (NPs) and nanostructures in conjunction with natural or synthetic receptors as molecular recognition elements provide opportunities for the design of sensitive and selective assays for rapid detection of contaminants. We look forward to the microbial sensor being a platform for the quality control and monitoring of the target microbial pathogens in medical, biological and environmental samples. the nano-microbial sensors could be used for monitoring of biofilm formation, pathogenic detection, as a highly sensitive cell viability assay, testing the susceptibility of microbial cells towards new antimicrobial agent(s).

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Douglas Holmes is an assistant professor in the Department of Mechanical Engineering at Boston University. He received degrees in chemistry from the University of New Hampshire (BSc 2004), polymer science and engineering from the University of Massachusetts, Amherst (MSc 2005, PhD 2009), and was a postdoctoral researcher in mechanical & aerospace engineering at Princeton University. Prior to joining Boston University, he was an assistant professor of engineering science and mechanics at Virginia Tech. His group's research specializes on the mechanics of slender structures, with a focus on understanding and controlling shape change. His research has utilized elastic instabilities to pattern surfaces with deformable shells, create ultralight mechanisms inspired by kirigami, described the mechanics of wrinkling and folding thin films, quantified the dynamics shape change of snapping beams and shells, and examined the fundamental interactions between granular materials and slender structures. He has received the NSF CAREER Award and the ASEE Ferdinand P. Beer and E. Russell Johnston Jr. Outstanding New Mechanics Educator award.

Poster #31

Structural engineering with rocks and string

Imagine the ability to rapidly erect basic infrastructure in a fully reversible and reusable manner using common, locally available materials, like rocks and string. In contrast to the construction of traditional engineering and architectural structures, which rely on the precise placement of carefully designed components and manual labor, what if we could build columns and walls by rapidly pouring their constituents in a disordered manner? In this work, we present a novel approach to developing reversible, amorphous metamaterials that are completely disordered on the scale of their local constituents, yet result in remarkably strong macroscale ordered structures that are resistant to static and dynamic loads. By utilizing the jamming of granular materials coupled with thin fibers capable of enhancing friction and bearing tensile loads, we are able to construct basic structural components - columns, arches, and walls that are capable of bearing large compressive loads.

The ability to use jammable, amorphous metamaterials to create rapid, reusable infrastructure components, such as walls and columns, from inexpensive, commonplace materials, such as rocks and string, may have significant broader impacts. These structures may aid in the construction of temporary shelters during disaster relief efforts, and may enable inexpensive, recyclable, and sustainable architectural elements. If suitable particles are used (e.g., hollow or soft particles), the structures can be lightweight. Furthermore, the amorphous structures may possess a phase transition similar to the glass transition observed in polymers where the degree of jamming is reduced to the extent that the aggregate becomes malleable again, thereby allowing the jammed aggregates can be reconfigured and re-shaped. As compared to traditional steel or concrete construction, directed assembly of granular materials offers unprecedented reversibility/recyclability, and morphability.

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Simi Hoque, PhD, PE, is an associate professor of architectural engineering at Drexel University. She is a Bangladeshi-American who grew up in Nigeria, immigrated to the US, and was educated at Johns Hopkins, Carnegie Mellon, and the University of California-Berkeley. Her research (NSF CAREER grant #1740449) is an urban metabolism analytical framework that integrates and predicts the impact of different sectors of the built infrastructure, transportation, and land use, on the environment. She presented this work in Morocco at AAFS in 2017. Dr. Hoque is also a licensed professional engineer who designs HVAC systems for high performance buildings. Her research is on the development and application of computational methods and tools to reduce building energy and environmental impacts. She is currently working on the development of analytical methods to predict the impact of climate change on building energy consumption. Using scenarios from the IPCC climate models and weather generators, she and her PhD students are identifying critical stresses and vulnerabilities to buildings due to changes in future weather patterns. Dr. Hoque lives near Philadelphia, she has three children, and she is deeply invested in advancing girls and women in STEM through her outreach work with Girls Inc. and other non-profits. She also enjoys reading novels, exercising, and trying to get 8 hours of sleep every night.

Poster #7

Climate change impacts on the built environment

Buildings are subject to significant stresses due to climate change. As climate change increases the range and frequency of volatile weather events, there may be a significant impact on operating costs to maintain optimal building performance. Predicting weather conditions due to climate change is a key aspect of assessing future building energy consumption. However, most building energy analyses either consider climate loads over a one-year period with a reference typical meteorological year (TMY) or implement an extreme reference year to evaluate performance at the upper and lower percentiles. These methods lack long-term performance characterization since they do not account for climate change. So, while a building is generally expected to have a service life of greater than 50 years, there is a critical gap in our understanding of how it will perform under future weather conditions. Moreover, we do not know how these effects should be understood in the context of urban energy consumption, and as a result, planners and utilities do not have the analytical tools to plan for the changes and impacts to come.

In this poster, we will present simulation techniques to analyze building energy consumption using future weather files generated by climate models, and visualization models that focus on how changes in urban energy policy impact building energy consumption. The goal of this research is to allow building designers and energy utilities to evaluate and plan for the impact of climate change on building energy consumption under different assessment scenarios from the Intergovernmental Panel on Climate Change. The practical outcome of this investigation is not only to provide guidance for the development of standards addressing new building design, but also to promote improved adaptation and mitigation strategies in the current building stock.

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David has a PhD in applied physics and is an assistant professor at the University of Pennsylvania. David›s lab combines microelectronics, microfluidics, and nanomaterials to create miniaturized platforms for the diagnosis of disease. This work requires an interdisciplinary approach in which engineers, scientists, and physicians work together to solve high impact problems in healthcare.

Poster #33

Scaling up micro- and nano-fluidics for disease diagnostics and drug manufacturing

The transformative growth in microelectronics in the latter half of the 20th century was fueled fundamentally by the ability to simultaneously miniaturize and integrate complex circuits onto monolithic chips. The impact of this growth has been profound– computing is pervasive and portable, communication is instant and global, and information is ubiquitously gathered and shared. My research aims to harness these same electrical engineering approaches, which have enabled the microelectronic revolution, to solve high impact problems in medical diagnostics. To accomplish this goal, my lab develops hybrid microchips, where microfluidics are built directly on top of semiconductor chips. These chips result in enormous streams of new data, which we process using machine learning algorithms.
Digital assays — in which ultra-sensitive molecular measurements are made by performing millions of parallel experiments in picoliter droplets — have generated enormous enthusiasm due to their single molecule resolution and robustness to reaction conditions. These assays have incredible untapped potential for disease diagnostics, environmental surveillance, and biosafety monitoring, but are confined to laboratories due to the instrumentation necessary to generate, control, and measure tens of millions of droplets. To overcome this challenge, we developed a hybrid microelectronic/microfluidic chip to ‘unlock’ droplet-based assays for mobile use. Our microDroplet Fluorescence Detector (μDFD) takes inspiration from cellular networks, in which phones are identified by their carrier frequency and not their particular location. In the same way, but on a much smaller scale, we screen millions of droplets per second using only a conventional smartphone camera. In collaboration with physicians, we demonstrated the power of this approach by developing a multiplexed exosome-based point of care diagnostic for the early detection of pancreatic cancer and prognosis of traumatic brain injury.

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Dr. Haikel Jelassi is an associate professor of physics and head of the research laboratory at the National Centre for Nuclear Sciences and Technologies (CNSTN) in Tunisia. Dr. Haikel Jelassi is interested in many research fields, including both fundamental and applied physics such as atomic, molecular and plasma physics. He›s in charge of the construction of the first Tunisian atomic clock. He is also interested in plasma Tokomak reactors and wastewater treatment by nuclear radiation. He has authored more than 25 scientific articles in peer-reviewed journals, and holds one patent. He has supervised several PhD and undergraduate students and is active through the Tunisian Physical Society where he acts as a member of the national board. He has organized several conferences and workshops in the North African and Arab regions. Dr. Jelassi is a member of three journal's editorial boards and is regularly asked to review papers for publications in peer-reviewed journals. He is TWAS young affiliate and member of the new TYAN network. Recently, he became an African Academy of Sciences young affiliate.

Poster #67

Gamma radiation induced degradation of some dyes in aqueous solutions

The aim of this study is to develop a new method for the elimination of some dyes present in wastewater using gamma radiation, and compare the result with conventional methods. In this study, the gamma radiation induced degradation of dyes was investigated. The dye solutions were irradiated by the cobalt 60 gamma source at dose of 0 to 20 kGy. Change of absorption spectra, chemical oxygen demand (COD) and total organic carbon (TOC) were carried out and studied. All results showed that gamma radiation was effective in removing dyes in aqueous solutions and its degradation confirmed the pseudo first order kinetics under applied conditions.

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Dr. Kabengi is an associate professor in the Department of Geosciences at Georgia State University, where she also holds a joint appointment with the Chemistry Department. She received her BSc and MSc in agricultural engineering and soil science from the American University of Beirut in Lebanon, where she was born and raised. She earned a PhD in soil physical vhemistry from the University of Florida. Dr. Kabengi's research explores fundamental surface chemical reactions occurring at interfaces between surfaces and aqueous solutions and the role – both basic and applied – these interfacial reactions play in technological, geochemical and environmental contexts, especially as related to the fate and transport of natural and anthropogenic contaminants in earth ecosystems. Dr. Kabengi's expertise lies in the application and construction of flow microcalorimeters techniques and instrumentations for measuring the energetics and thermodynamic properties of various chemical surface reactions. Other work in Dr. Kabengi's lab explores the availability and mobility of contaminants, colloids and manufactured nanoparticles. Her research methods incorporate laboratory/experimental studies and field work using a wide suite of analytical techniques. Dr. Kabengi has received an award from the U.S. Department of Energy, Office of Basic Energy Sciences, Faculty Career Development (CAREER) program for her work on furthering in-situ thermodynamics measurements.

Poster #53

Adsorption of oxyanions on ferrihydrite studied by flow microcalorimetry and computational chemistry

The long-term goal of this research is to improve the prediction of the fate and transport of contaminants in aquatic and terrestrial systems. Iron oxides and hydroxides are ubiquitous in nature, existing as relatively pure minerals such as goethite and hematite; but ferrihydrite (Fhy), a poorly crystalized hydrous oxyhydroxide phase, is the most abundant. Because of its high specific surface area and reactivity, Fhy plays a critical role in controlling the solubility and mobility of pollutants in the environment. Adsorption on surfaces has been studied extensively using a variety of spectroscopic and chemical techniques, but computational chemistry using Density Functional Theory (DFT) is increasingly being used to understand and predict the fate of environmental contaminants. However, DFT computations are not always directly compared to experimental data, especially thermodynamic data because the literature on the thermodynamics of key reactions controlling contaminants behavior, such as adsorption, remains scarce. In this work, we address this deficiency by using both unique custom-made flow microcalorimeters and DFT to complete a systematic study of the energetics of adsorption of five important oxyanions/contaminants: phosphate, chromate, sulfate, carbonate, and arsenate. This choice was guided by their environmental relevance, their expected interaction strength, and their expected effect on the surface. The real-time collaboration between the experimental and computational work allowed for rapid adjustment of model configurations and computational methods and for the identification of the cause of discrepancies observed between experiments and simulations. Developing computational methodologies that can be tested against experimental thermodynamics advances our ability to utilize computational chemistry to accurately model and predict the fate and transport of contaminants in our efforts to safeguard the future of our environmental resources.

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Dr. Khomsi has been the head of the Air Quality Department within the National Climate Center at the Morocco Meteorology Office since March 2016. She earned a PhD in climatology and climate change from the Faculty of Sciences of Rabat in 2014, a master's degree in theoretical and applied mechanics from the Faculty of Science of Ben Mesik in Casablanca in 2007 and an engineering degree in atmospheric science from the Hassania School of Public Works for engineers in Casablanca in 2004. She has an advanced certification in mentoring from Mentoring Standard in the United States. Her research interests revolve around air quality, climatology and climate change.

Poster #45

The co-occurrence of extreme ozone and hot temperature events and impact of the general circulation

Temperature is the first meteorological factor directly involved in leading ozone (O3) extreme events. Generally, upward temperatures increase the probability of having exceedance in ozone adopted thresholds. In the global climate change context, more frequent and/or persistent heat waves and extreme ozone (O3) episodes are likely to occur during in coming decades and a key question is about the coincidence and co-occurrence of these extremes.

In this paper, using seven years of surface temperature and air quality observations over two cities from Morocco (Casablanca and Marrakech) and implementing a percentile thresholding approach, we show that the extremes in temperature and ozone (O3) cluster together in many cases and that the outbreak of ozone events generally match the first or second days of heat waves.

This co-occurrence of extreme episodes is highly impacted by humidity and overlapping large-scale episodes. This relationship was investigated through assessing the statistical correlations between extreme ozone, humidity, and climatic indexes (North Atlantic Oscillation (NAO) and Mediterranean Oscillation (MO)) in the studied area.

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Dr. Kostas Konstantinidis joined the School of Civil and Environmental Engineering at Georgia Institute of Technology as an assistant professor in November 2007, and has held the Maulding Faculty Fellow Chair in Environmental Engineering since September 2012. His education and research interests are at the interface of environmental microbiology with engineering, genomics and computational biology. The overarching goal of his research is to broaden our understanding of the genetic and metabolic diversity of the smallest organisms on the planet, the bacteria and archaea, and the role of this diversity for ecosystem function and resilience to natural as well as anthropogenic perturbations. He has published more than 92 peer-reviewed articles, ten in PNAS alone, and six book chapters in these research areas, which have received in excess of 9,000 citations (Google Scholar). Dr. Konstantinidis has received several national and international distinctions and awards for his work, including the 2010 Skerman Award.

Poster #35

The Enve-Omics Lab: At the interface of microbial ecology with engineering and bioinformatics.

Our laboratory focuses on the smallest organisms, the bacteria and the archaea (“the prokaryotes”), which drive the life-sustaining processes on Earth. Our long-term goals are to broaden our understanding of the genetic and metabolic diversity of the prokaryotes on the planet, and the role of this diversity in ecosystem function and for resilience to human-induced perturbations. We are also interested in the biotechnological applications of microbial diversity in the bioremediation of environmental pollutants and the assessment of water quality. Our incomplete understanding of the microbial world is attributed, at least in part, to the fact that the great majority of microorganisms resist cultivation in the laboratory and thus, cannot be studied efficiently. Therefore, another major objective of our lab is to develop novel culture-independent (aka metagenomics) and bioinformatics approaches to study microbial communities in-situ, in both engineered (e.g., bioremediation and wastewater treatment reactors) as well as natural (e.g., terrestrial or marine) systems. Illustrative examples of the abovementioned research goals will be provided in this presentation.

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Dr. Emily Kumpel is an assistant professor in the Department of Civil and Environmental Engineering at University of Massachusetts Amherst. She has an MSc and PhD in civil and environmental engineering from the University of California, Berkeley, and a BSc in mechanical engineering from Johns Hopkins University. Dr. Kumpel has over a decade of experience conducting research, with topics including intermittent water supply, water quality in distribution systems, water access and equity, water quality monitoring, and use of information and communication technologies in water delivery systems. She has published 19 peer-reviewed scientific papers and currently advises six students working on projects related to water quality, sampling, and household water access with projects in India, Kenya, and Mexico. Prior to joining the faculty at UMass, Dr. Kumpel was a senior research scientist with the Aquaya Institute, where she was based in Nairobi, Kenya, for three years and engaged in research and training on water quality monitoring, water safety plans, and impact evaluations. She has conducted extensive field research in India, Kenya, Senegal, and Nigeria, and collaborated on research projects in more than a dozen other countries throughout Africa and Asia.

Poster #37

Effects intermittent operation of piped water distribution systems on water quality

Loss of pressure in water distribution systems affects the complex biological, chemical, and physical mechanisms influencing the quality of drinking water as it flows from source or treatment plant to consumer taps. Despite the importance of maintaining continuous, positive pressure in water distribution systems, more than one billion people in low- and middle-income countries are supplied with water through intermittent water supply (IWS) systems, which are distribution systems that supply water for fewer than 24 hours per day. The objective of this research is to investigate the microbiology of bulk water and biofilms in pipes that experience regular interruptions to supply to elucidate the role of intermittent water supply in the transport, survival, and growth of enteric pathogens. The hypothesis is that frequent interruptions to pressurized water supply affect the structure and composition of biofilms, the growth of bacteria, and the persistence and release of enteric pathogens within the pipes, with the effect of negatively influencing the quality of the water received at the tap. We present preliminary data from experiments with a laboratory-scale pipe loop operated with separate supply regimes (continuous supply, 12 hours of supply every day, and 12 hours of supply twice per week) to understand the mechanisms affecting the microbiological quality of water in intermittently supplied piped water distribution systems. Gaining a more fundamental understanding of how these supply interruptions affect the microbiology of pipes can lead to the development of strategies for improving water quality and therefore reducing the risks to health posed by chronically intermittent networks and by interruptions to otherwise continuously pressurized distribution systems.

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Professor Liu received his PhD at the University of Washington and completed postdoctoral training at UC Berkeley before joining UC Riverside in 2013. Professor Liu›s research interests include water chemistry, metal behavior, water reuse and treatment, environmental remediation, electrochemistry and catalysis. His current and recent research has been sponsored by the National Science Foundation, Department of Interior, Department of Agriculture, Department of Energy and Water Research Foundation. He has active collaborations with faculty in engineering, chemistry, environmental sciences and toxicology, as well as international collaborations in Italy, Switzerland and China to address interdisciplinary and global environmental challenges. Professor Liu is a member of several professional societies and currently serves on the International Water Association›s specialist committee on metals and toxic substances in drinking water. Professor Liu was selected as an Emerging Investigator in Water Engineering and Technology by the Royal Society of Chemistry in 2016, and received a United States National Science Foundation Faculty Early Career Development (CAREER) award in 2017.

Poster #39

Harnessing water chemistry to address complex water challenges for a thirsty world

Water scarcity has become a global crisis. This situation is exacerbated – and will continue to be so – by the global shrinkage of surface water sources. Meanwhile, large populations have grown in these warm and arid regions. This shift in population and associated water demand make it extremely challenging and expensive to find high-quality natural water sources. Wastewater reuse offers the potential to significantly increase the global total available water resources. The major challenge to recycling is the development of efficient and cost-effective purification processes. In particular, our existing water treatment systems are poorly equipped to deal with trace organic chemicals including pharmaceuticals and personal care products, petroleum hydrocarbons, and industrial solvents that are often present in the effluent.

Meanwhile, ultraviolet-driven advanced oxidation processes (UV/AOP) are becoming increasingly important for potable water reuse to remove trace chemical contaminants from wastewater effluent. The unique aqueous photochemistry of the overlooked but important chloramines can provide a novel approach for water reuse. Membrane treatment processes including microfiltration (MF) and reverse osmosis (RO) are employed prior to any UV/AOP in water reuse facilities. Chloramines are deliberately generated in the feed water to minimize membrane biological fouling. Because of their small molecular size and neutral charge, chloramines easily diffuse through RO membranes, and subsequently will undergo photolysis in the UV/AOP. The photolysis of chloramines produced amine and halide radicals, which further transformed to a series of reactive radical species that assist the contaminant degradation. These novel findings show that the presence of chloramines in UV/AOP as carry-over chemical residuals from membrane treatment processes can also be harnessed as an oxidant beneficial to water reuse.

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Dr. Ting Lu is an associate professor in the Department of Bioengineering and the Carl R. Woese Institute for Genomic Biology at the University of Illinois at Urbana-Champaign (UIUC). He received a BSc in physics from Zhejiang University in 2002 and Ph.D. in Biophysics from UC-San Diego in 2007. Prior to joining UIUC in 2011, Dr. Lu was a postdoctoral researcher at Princeton, MIT, and Wyss Institute at Harvard. Dr. Lu's research focuses on synthetic biology -- the analysis, construction and utilization of bacterial gene networks for cellular functionality programming. In particular, he is interested in mathematical modeling and experimental construction of microbial ecosystems. He has received several awards for his research, including ONR Young Investigator Award, NSF CAREER Award, ACS Infectious Diseases Young Investigator Award, and Young Innovator of Cellular and Molecular Bioengineering.

Poster #41

Designing microbial consortia with defined social interactions

Designer microbial consortia are an emerging frontier in synthetic biology that enables versatile microbiome programming. However, the utilization of such consortia is hindered by our limited capacity in rapidly creating ecosystems with desired temporal and spatial dynamics. Here we present the development of synthetic microbial communities from social interaction engineering that combines modular pathway reconfiguration with model creation. Specifically, we created six two-strain consortia, each possessing a unique mode of interaction, including commensalism, amensalism, neutralism, cooperation, competition and predation. These consortia follow distinct population dynamics with characteristics determined by the underlying interaction modes. We showed that models derived from these two-strain consortia can be used to design more complex ecosystems (three- and four-strain consortia) with predictable dynamics, and further extended to provide insights into population dynamics in spatially heterogeneous settings. This work sheds light on the organization of interacting microbial species, and provides a systematic framework—social interaction programming—to guide the development of synthetic ecosystems for diverse purposes.

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Michail Maniatakos is an assistant professor of electrical and computer engineering at New York University (NYU) Abu Dhabi, Abu Dhabi, U.A.E., and a research assistant professor at the NYU Tandon School of Engineering, New York, NY, USA. He is the director of the MoMA Laboratory, NYU Abu Dhabi. He received his PhD in electrical engineering, as well as MSc and MPhil degrees from Yale University, New Haven, CT, USA. He also received BSc and MSc degrees in computer science and embedded systems, respectively, from the University of Piraeus, Greece. His research interests, funded by industrial partners, the US government, and the UAE government, include robust microprocessor architectures, privacy-preserving computation, smart cities, as well as industrial control systems security. Prof. Maniatakos has authored several publications in IEEE transactions and conferences, holds patents on privacy-preserving data processing, and he serves in the technical program committee for various international conferences. He has organized several workshops on security, and he currently is the faculty lead for the Embedded Security challenge held yearly worldwide as part of the NYU Cyber Security Awareness Week. His latest vulnerability discovery was featured at BlackHat USA 2017, and extensively covered by Reuters and BBC.

Poster #34

Smart city testbed for cybersecurity research

Motivated by growing global needs to create more comfortable urban spaces as world urbanization continues to grow and as the global population is expected to double by 2050, smart cities are emerging as a priority for research and development across the world. Smart cities are forward-looking, progressive and resource-efficient while providing at the same time a high quality of life. Smart cities, however, pose many research challenges spanning multiple disciplines.

The NYU Abu Dhabi Smart City Testbed is a collection of interconnected processes, each one consisting of simulation models, hardware devices, and appropriate network protocols for the connection to central Internet of Things (IoT) platform. Currently, the testbed instantiates eight processes:
1) Smart Grid, 2) Intelligent Transportation, 3) Chemical Plant,
4) Smart House, 6) Smart Building, 7) Water Desalination Plant,
and 8) Additive manufacturing facility.

The testbed serves as the base for ground-breaking research, training/certification programs, and as a facility to experiment before deployment. It includes hundreds of devices deployed in a smart-city, along with their industrial protocols, the human-machine interfaces, and any relevant software. The testbed allows research throughout the computational stack layers:
1) Hardware, 2) Firmware, 3) Software, 4) Network, and 5) Control layer.

The testbed is a living organism which is ever-growing and expanding, depending on current needs, research interests, and available resources. The testbed facilitates research for security researchers with limited resources and domain expertise, as well as professionals outside the security and privacy domain.

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Dr. Bridget Martinez completed her doctorate degree (PhD) in the field of molecular and cellular biology and comparative physiology at the University of California in Merced. As a comparative physiologist, Bridget›s research focused on expanding our knowledge of the evolution of endocrine systems in prolonged fasting-adapted mammals. Bridget is an extensively published author with results from her studies having impactful biomedical implications. In addition, she has published and edited three books which strive to provide comprehensive scientific knowledge in various biomedical fields in publishing groups such as Nature and the Royal Society of Chemistry. Her most current book identifies prognostic biomarkers for disease, as well as evaluates translational value from clinical trials. With her second doctoral degree (MD), Dr. Martinez strives to bridge the gap between the advancement of scientific knowledge and improve therapeutic strategies for patients. As an NIH, Minority Health and Health Disparities International Research Training Program Fellow (MHIRT); her academic and research training includes extended experiences from all around the world.

Poster #42

Modal analysis of cancer metastasis

Traditionally, performing an experimental modal analysis of a building/structure required instrumenting the structure with a spatially distributed array of accelerometers or strain gages. Alternatively, a laser doppler vibrometer would have to be scanned across the structure of interest in a sequential manner to measure structural response. Recently, researchers at LANL developed a technology that combines the theory of structural dynamics with computer vision that provides the capability to characterize structural dynamics at very high spatial density using only an imager. With this newfound success at the macro-scale, we have exploited this novel technology to a whole new scale- to studying the basic structure of life itself, the human cell. We hypothesize that this new technology and novel application will provide a significantly better understanding of how stiffness and mass distribution changes in a cell as it undergoes epithelial-mesenchymal transition, and in identifying its associated EMC biochemical cues, highlight potential therapeutic targets. For the first time it should be possible to measure the high-resolution mode shapes of cells; given that all cells undergoing cancer metastasis experience a breakdown in the cytoskeleton, this work will enable groundbreaking advances. It is imperative to highlight, that we are only beginning to understand the relationship between biophysical properties of cells and their potential to regulate tumorigenesis and motility. This knowledge could be used to provide verification and validation of finite element models of cellular structure. This work will represent the first time that expertise in experimental structural dynamics will be brought to bear on the problem of characterizing the structural dynamics of cells at high spatial resolution, which is novel and unique on its own. When successful, this new technology could be used to couple the biophysical cues associated with other detrimental human pathologies.

Mostafa Mobasher

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Mostafa Mobasher is currently a project engineer in the Weidlinger Applied Sciences practice of Thornton Tomasetti, (TT). At TT, his work spans on advanced finite element modeling for various engineering applications, research and development in applied/computational mechanics, technology transfer and software development. Mostafa is also a developer of the advanced material failure modeling package VistaMat Suite. Mostafa received his PhD and MPhil degrees in civil engineering and engineering mechanics from Columbia University in 2017, master's degree from Cairo University, and bachelor's degree from Loughborough University. His dissertation work focused on developing enhanced computational damage mechanics models for geomaterials including rocks and ice.

Poster #44

Hyperloop: Infrastructure security implications of the revolutionary transportation mode

Hyperloop, as a novel transportation solution, comprises a car (pod) flying at the speed of planes on a guided path in near-space conditions. This revolutionary system possesses an unprecedentedly challenging infrastructure security case. As a critical infrastructure component, the design of the Hyperloop should consider aspects beyond service loading. Extreme loading scenarios such as earthquakes, missiles attack, blast and fire would introduce additional risks. Failure modes such as pod-pod or pod-tube crash, implosion, explosion, pressure wave propagation and others may occur and trigger a chain reaction series of failures. Therefore, Hyperloop security needs to be analyzed and validated from a multi-hazard point of view to ensure the safety of passengers and surrounding communities. We present Thornton Tomasetti, Inc. capabilities to validate Hyperloop's safety from a multi-hazard and vulnerability point of view. Also, we demonstrate our capabilities to quantify the risk associated with operating the Hyperloop and verifying its insurability.

Safa Motesharrei

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Currently at the University of Maryland, College Park (UMD), Dr. Safa Motesharrei is a systems scientist whose focus is on the integration of the human system into the earth system models. He has bachelor›s degrees in electrical engineering and physics, master›s degrees in physics and mathematics, and PhD in applied mathematics / public policy from UMD. He works with a cross-disciplinary team of distinguished scientists, including several members of the US National Academies. Their perspective paper, Modeling Sustainability, was published in 2016 in National Science Review (NSR), and has become the most read paper of NSR. Dr. Motesharrei›s most recent research on renewable solar and wind farms in the Sahara was published in Science on Sep 7, 2018.

Poster #46

Climate model shows large-scale wind and solar farms in the Sahara increase rain and vegetation

Wind and solar farms offer a major pathway to clean, renewable energies. However, these farms would significantly change land surface properties, and, if sufficiently large, the farms may lead to unintended climate consequences. In this study, we used a climate model with dynamic vegetation to show that large-scale installations of wind and solar farms covering the Sahara lead to a local temperature increase and more than a twofold precipitation increase, especially in the Sahel, through increased surface friction and reduced albedo. The resulting increase in vegetation further enhances precipitation, creating a positive albedo–precipitation–vegetation feedback that contributes ~80% of the precipitation increase for wind farms. This local enhancement is scale dependent and is particular to the Sahara, with small impacts in other deserts.”

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Ahmed Moustafa is an associate professor of bioinformatics and systems biology at The American University of Cairo with a tenured appointment in the Department of Biology. He is also an adjunct scientist in the Department of Medical Genomics at J. Craig Venter Institute. Ahmed's research focuses on elucidating the interaction between the microbiome and human genetic variation and its association with health and disease. He is also interested in deciphering the functional and pathogenic roles of the non-coding component of the human genome. To achieve these goals, he uses genomic analytics, statistical genetics, and machine learning to analyze high-dimensional datasets generated from high-throughput experimental protocols, from genomic and transcriptomic to proteomic and metabolomic.
Ahmed has co-authored many highly cited publications in prominent journals. His research has been funded by various funding agencies including NIH, NSF, and NASA. Ahmed grew up in Alexandria where he graduated with BSc in Computer Science from Alexandria University. After completing his PhD in genetics at the University of Iowa, he received a post-doctoral fellowship at J. Craig Venter Institute prior to joining The American University in Cairo.

Poster #48

Interaction between host genome and gut microbiome in inflammatory bowel disease

Inflammatory bowel diseases (IBD), comprised of Crohn's disease (CD) and ulcerative colitis (UC), are characterized by a complex pathophysiology that is thought to result from an aberrant immune response to a dysbiotic luminal microbiota in genetically susceptible individuals. New technologies support the joint assessment of host-microbiome interaction. Using whole-genome sequencing and shotgun metagenomics, we studied the clinical features, host genome, and stool microbial metagenome of IBD patients, and compared the results to control individuals. Genetic risk scores, computed on IBD single nucleotide variants, and human leukocyte antigen (HLA) types differentiated IBD patients from healthy controls. Genetic risk was associated with the need for use of biologics in IBD and, modestly, with the composition of the gut microbiome. As compared with healthy controls, IBD patients had hallmarks of stool microbiome dysbiosis, with loss of a diversified core microbiome, enrichment and depletion of specific bacteria, and enrichment of bacterial virulence factors. We show that genetic risk may have a role in early risk stratification in the care of IBD patients and propose that expression of virulence factors in a dysbiotic microbiome may contribute to pathogenesis in IBD.

Amin Nawahda

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Amin Nawahda holds a PhD in civil engineering from Kyoto University, Japan, a master's degree in water engineering from Birzeit University, Palestine, and a BEng in mechanical engineering from the Birzeit University. Currently, he works as the head of the Mechanical Engineering Department at Palestine Technical University-Kadoori (PTUK). He has more than 20 years of combined education, research, and training experience in environmental engineering in East Asia and the Middle East. Dr. Nawahda is the author of many scientific papers in the following fields; environmental pollution, risk assessment, environmental modelling, data mining, GIS, hydrology, and environmental monitoring.

Poster #23

GIS based method for the characterization of atmospheric dust particles

The aim of this study was to develop a method for extracting some of the physical characteristics of dust particles based on analysis of microscopic images. Dust samples were collected from Sohar Industrial Port (SIP) in Oman and the images of the dust samples were taken using a digital microscopic camera. These images were preprocessed and analyzed using Geographical Information System (GIS) software and a computer code developed for segmentation and analysis of different features such as number of particles and color. Results from the developed image analysis method show promising results using an affordable technique.

Richard Peltier

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Dr. Richard Peltier is an associate professor in the Department of Environmental Health Sciences at the University of Massachusetts Amherst. He is an expert in air quality assessment and human exposure science and has substantial focus in chemical speciation of aerosol components, source apportionment, and attribution of specific sources to specific health outcomes. He has extensive experience in conducting research projects in remote locations where traditional research approaches are particularly difficult. As an empiricist, his laboratory is centered on high quality data analysis, uncertainty in sparse datasets, and reducing exposure misclassification. Effective science communication to engage the public is also of significant interest, and he is involved in production of effective dissemination tools of scientific findings through mass media. Dr. Peltier completed a MPH from Columbia University, and a PhD in atmospheric chemistry from the Georgia Institute of Technology. A former Rosenblith awardee from the Health Effects Institute, Dr. Peltier has prior or current funding from US EPA, the Institute for Advanced Sustainability Studies, World Resources Institute Ross Center for Sustainable Cities. Climate and Health Research Network, and Massachusetts Department of Energy Resources. Dr. Peltier is a recipient of a US-UK Fulbright award, and is the deputy editor in chief of the Journal of Exposure Science and Environmental Epidemiology.

Poster #49

Air quality insight from open source data: OpenAirLocal

Exposure to poor air quality is widely understood to be detrimental to human health, and while this burden is distributed globally, its impacts are most prominent in the most polluted regions of the world. Air quality data is most often collected by national or local government agencies, and this data is (or should be) a public good. However, despite meeting regulatory requirements, data collection agencies often leave this data poorly analyzed and or used in a way that provides no significant insight to the population to which it is applied. Thus, there exists a clear need for meaningful interpretation of this data in ways that are impactful to society. This presentation will focus on a set of open-source software tools that are designed to greatly improve access to air quality data by providing advanced analytical tools to consumers of this data requiring little analytical experience or any software coding. These tools, collectively called OpenAirLocal, are freely available and modifiable, and can be applied to existing or planned air quality datasets anywhere in the world. They provide rapid insight into how air quality might vary across different time periods, how it is distributed in space, or can be easily compared with long term trends. Current applications of OpenAirLocal include the OpenAQ dataset, as well as the historical long term data set that has been collected by the United States Environmental Protection Agency and the European Environment Agency. Custom applications for researchers in air quality and big data are easily adapted using this platform.

Dimitrios Peroulis

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Dimitrios Peroulis is Reilly Professor of Electrical and Computer Engineering and the associate dean for external affairs in the College of Engineering at Purdue University. He received his PhD in electrical engineering from the University of Michigan at Ann Arbor in 2003. His research is focused on reconfigurable electronics, cold-plasma RF electronics, and wireless sensors. He has been a key contributor in developing high quality widely-tunable filters and novel filter architectures based on miniaturized high-Q cavity-based resonators in the 1-100 GHz range. He is also currently leading unique research efforts in high-power multifunctional RF electronics based on cold-plasma technologies. He received the National Science Foundation CAREER award in 2008. He is an IEEE fellow and has co-authored over 300 journal and conference papers. In 2014 he received the Outstanding Young Engineer Award of the IEEE Microwave Theory and Techniques Society (MTT-S). In 2012 he received the Outstanding Paper Award from the IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society (Ferroelectrics section). His students have received numerous student paper awards and other student research-based scholarships. He has been a Purdue University Faculty Scholar and has also received ten teaching awards including the 2010 HKN C. Holmes MacDonald Outstanding Teaching Award and the 2010 Charles B. Murphy award, which is Purdue University›s highest undergraduate teaching honor.

Poster #51

Wireless Sensors for Monitoring Pharmaceutical Lyophilization

Lyophilization, or freeze-drying, is a commonly used and well-established process to preserve the original structure of a heat sensitive biological and/or pharmaceutical product (e.g. anti-body, peptides, vaccines, etc.) during drying and, moreover, during long-term storage (extending the shelf life of pharmaceutical formulations). Freeze-drying involves ice removal from a frozen product at low pressure through a sublimation process. It was reported by the Food and Drug Administration (FDA) about 50% of over 300 FDA and EMA approved biopharmaceutical products are freeze-dried.

A typical freeze-drying cycle consists of three steps: freezing, primary drying, and secondary drying. Product temperature is critical in all steps and is traditionally monitored using a single-point sensor such as thin wire thermocouples and resistance thermal detectors (RTD, PT-1000) in a lab environment. Due to the different location of the vials, the vials' temperature profiles might be very different across the freeze dryer when considering the variation in the vial heat transfer coefficient and the variation between different freeze dryers. While this difference may be inconsequential in the laboratory, the significant larger batch size in manufacturing leads to substantially higher different temperature profile of the freeze drying, resulting in larger differences between vials across the freeze dryer chamber.

In this poster we discuss the design and evaluation of a fully wireless, multi-point temperature sensor system as a Process Analytical Technology (PAT) for lyophilization. Each sensor contains seven sensing elements which measure the product temperature at various positions of the contents of a glass vial. The sensor performance has been validated through a variety of freeze drying experiments.

Cassandra Quave

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Dr. Cassandra Quave is curator of the herbarium and assistant professor of dermatology and human health at Emory University, where she leads drug discovery research initiatives and teaches courses on medicinal plants, food, and health. Trained as a medical ethnobotanist, her research focuses on the documentation and biochemical analysis of botanical remedies used in the traditional treatment of infectious and inflammatory skin disease. She earned her BSc in biology and anthropology from Emory in 2000, her PhD in biology from Florida International University in 2008, and completed post-doctoral fellowships in microbiology at UAMS (2009-2011) and human health at Emory (2012). She has authored more than 60 publications, two edited books and three patents. She is the co-founder and CEO/CSO of PhytoTEK LLC, a drug discovery company dedicated to developing solutions from botanicals for the treatment of antibiotic resistant infections and recalcitrant wounds. She is also a past president of the Society for Economic Botany, an international society with the mission of fostering research and education on the past, present, and future uses of plants by people. She has been the subject of feature profiles in the New York Times Magazine, BBC Focus, Brigitte Magazin, National Geographic Channel, and NPR.

Poster #55

Modulation of virulence in the skin microbiome by botanical natural products

Of the nearly 400,000 plants on Earth, around 28,000 of them are used in traditional and complementary medicine (TCAM). Each plant tissue is rich in secondary metabolites – or a chemical language – that allows plants to communicate with other organisms in their ecosystem, defend themselves from harm, and entice pollinators and seed dispersers. Bacteria also leverage chemical communication systems to coordinate group behaviors that are crucial to virulence, pathogenesis, and survival in different ecosystems, including plant and human hosts. The topical application of botanicals plays an important role in TCAM globally, and yet the mechanistic basis of many of these therapies remains poorly understood. In the environment of the skin, we have found that certain botanicals influence the composition and behavior of species in the skin microbiome. Plant secondary metabolites can not only impact microbiome composition through growth inhibitory action against skin commensals and pathogens, but also interfere with microbial signaling pathways (quorum sensing) responsible for virulence and pathogenesis in infectious and inflammatory disease. We have identified two medicinal botanicals *(Castanea sativa* and *Schinus terebinthifolia)* with quorum sensing inhibiting activities against Staphylococcus aureus, including a panel of isolates derived from pediatric atopic dermatitis patients. Here, we will present data on inhibitors discovered in medicinal plants used for the traditional treatment of skin disease and discuss potential utility as adjuvant therapies that target microbiome dynamics as a means of managing chronic inflammatory atopic skin disease.

Nima Rahbar

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Dr. Rahbar received his PhD in mechanics, materials and structures from the Department of Civil Engineering at Princeton University in 2008. After four years at University of Massachusetts, he joined WPI in August 2012. His research interests are in the area of bioinspired design of materials with an emphasis on mechanical and thermal. He is currently an associate professor in civil engineering and mechanical engineering at WPI. Less than 10 years from receiving his PhD from Princeton University, Nima Rahbar has accommplished a significant body of work in three major fields in mechanics and materials engineering. In the field of bioinspired design of materials, he has made significant contributions by focusing on inspirations from mechanics of tooth, cartilage, bamboo and nacre. In this field, He has recently focused on inspiration from lipid bilayers on design of active nanoscale thermal diodes. Since the completion of his PhD, he has been working on adhesion and interfacial fracture mechanics where he introduced a method to extract adhesion energies from AFM experiments, and later used molecular dynamics simulations to verify it. Dr. Rahbar has published more than 60 journal papers and won several awards including NSF CAREER award in 2012, TMS Young Leader's award in 2013, Air Force Summer Faculty Fellowship Award in 2013, Consecutive 2015 and 2016 Outstanding Reviewer, ASCE Journal of Nanomechanics and Micromechanics, and 2018 Sigma Xi Outstanding Junior Faculty Research Award.

Poster #62

Bioinspired design of structural and thermal materials

This talk focuses on the fundamental ideas arising from understanding the mechanisms behind the superior mechanical and thermal properties of biological materials through four specific examples of nacre, bamboo, cartildge, teeth, and lipid bilayers. The mechanical behavior and toughening mechanisms of abalone nacre-inspired multilayered materials are explored. In nacre›s structure, the organic matrix, pillars and the roughness of the aragonite platelets play important roles in its overall mechanical performance. A micromechanical model for multilayered biological materials is proposed to simulate their mechanical deformation and toughening mechanisms. The modeling results are in excellent agreement with the available experimental data for abalone nacre. Bamboo, a fast-growing grass, has higher strength-to-weight ratios than steel and concrete. The unique properties of bamboo come from the natural composite structure of fibers that comprises mainly cellulose nanofibrils in a matrix of intertwined hemicellulose and lignin called lignin-carbohydrate complex (LCC). Here we have experimentally and numerically studied mechanical and fracture properties of bamboo at multiple scale. We have utilized atomistic simulations to investigate the mechanical properties and mechanisms of the interactions of these materials in the structure of bamboo fibers. Lastly, given the amphiphilic nature and chemical structure, phospholipids exhibit a strong thermotropic and lyotropic phase behavior in an aqueous environment. We performed non-equilibrium molecular dynamics simulations for a range of different temperature gradients. The results show that the thermal properties of the DPPC bilayer are highly dependent on the temperature gradient. Higher temperature gradients cause an increase in the thermal conductivity of the DPPC lipid bilayer. These results provide significant new insights into developing new thermal insulation for engineering applications.

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Aaswath Raman is an assistant professor of materials science and engineering at UCLA. His research interests include nanophotonics, meta-materials, building envelope efficiency, energy systems and machine learning. He is also co-founder and chief scientist of SkyCool Systems, where he led the commercialization and development of radiative sky cooling, a technology that he originally developed as a research associate at Stanford University beginning in 2013. Aaswath received his PhD in applied physics from Stanford University in 2013, and his AB in physics and astronomy, and MS in computer science from Harvard University in 2006. He has published more than 25 peer-reviewed articles in leading journals including Nature, Nature Energy, PNAS and Physical Review Letters. Prior to obtaining his PhD he was a program manager at Microsoft.

He is the recipient of the Sir James Lougheed Award of Distinction from the Government of Alberta, Canada, the SPIE Green Photonics Award for his work on solar cell research and the Stanford Postdoctoral Research Award. In recognition of his breakthroughs in developing radiative sky cooling, in 2015 Aaswath was named one of MIT Technology Review's Innovators Under 35 (TR35) as an Energy Pioneer, and more recently, was invited to speak at TED 2018.

Poster #57

Harnessing the cold of space as a renewable resource: Radiative sky cooling

Nanoscale photonic structures and meta-materials, by their small length scales, can manipulate light and heat in unprecedented ways, thereby enabling new technological possibilities for building-related energy efficiency and generation. In this poster, I will show how nanophotonic structures and meta-materials can control the broadband electromagnetic fields associated with mid-infrared thermal radiation and sunlight to harness an unexploited thermodynamic resource – the cold of space – to improve the efficiency of terrestrial energy conversion systems.

I will present our body of work on radiative sky cooling, whereby sky-facing, thermal nanophotonic structures can passively cool themselves below their surroundings by emitting their heat as thermal radiation at wavelengths where Earth›s atmosphere is most transparent. I will show the first experimental demonstration of how this passive cooling effect can persist during the day under sunlight and show that, with selective thermal emitters and improved thermal engineering, a world record of 45°C below ambient can be achieved. I will also introduce two examples of how this approach can improve the efficiency of energy conversion processes: in solar cells, and vapor compression cycles. My results will show how this approach to cooling can improve the efficiency of today›s air conditioning and refrigeration system as much as 40%, and also form the basis of entirely passive approaches to tomorrow›s cooling systems.

Finally, I will highlight new fundamental and applied research directions for controlling light and thermal radiation, particularly at mid-infrared wavelengths. We now have the remarkable opportunity to tackle important energy and environmental challenges by better controlling the radiative heat transfer happening around us everyday.

Warren Ruder

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Dr. Warren Ruder moved his research group to the University of Pittsburgh's Bioengineering Department in January of 2017. Previously, he spent four years as an assistant professor in Virginia Tech's Biological Systems Engineering Department, where he led the Engineered Living Systems Laboratory. His expertise is in synthetic biology, cellular and molecular biomechanics, and lab-on-a-chip systems. Dr. Ruder received his PhD in biomedical engineering and his MSc in mechanical engineering from Carnegie Mellon University, and his BSc in civil and environmental engineering from MIT. From 2003-2005, he was a health science specialist at the Veterans Affairs Boston Healthcare System and Harvard Medical School. From 2005-2009, Dr. Ruder was an inaugural NIH trainee in the Pitt-CMU Biomechanics in Regenerative Medicine program and a Dowd graduate fellow in the groups of Phil LeDuc and Jim Antaki. From 2010-2012, he was a postdoctoral research associate in the group of Jim Collins at Boston University (now at MIT), and Harvard University's Wyss Institute for Biologically Inspired Engineering.

Poster #58

Exploring stochastic gene expression in the microbiome using biomimetic robots

Multiple research studies have revealed a strong connection between the gut microbiome and the behavior of its host. This connection between the microbiome and the brain, known as the gut-brain axis (GBA), has been found to impact many behaviors including anxiety and depression. Microbes frequently exist in spatially structured, biofilm communities. We constructed a microfluidic bioreactor that mimics the spatial diversity and biotransport properties found within biofilms. When we inoculated the bioreactor with E. coli harboring canonical synthetic biological circuits (e.g., a toggle switch), we repeatedly observed stochastic gene expression at specific, predictable locations within a single colony. We then coupled this spatially discretized information processing within the living *E. coli* colony to a mobile robot that mimicked a host. By establishing a simple set of motion primitives, activated at specific gene expression levels, we were able to observe multiple modes of complicated emergent behavior in the host biomimetic robot resulting only from stochastic gene expression in the colony. Our approach allows us to visualize a direct link between the physics of biotransport in biofilms, synthetic gene circuit behavior, and simulated host behavior. We anticipate these results will impact fields ranging from GBA physiology to experimental robotics.

Sahel Alouneh

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Sahel Alouneh is a full professor of electrical and computer engineering. Dr. Alouneh has been the dean of the Faculty of Electrical Engineering and Information Technology at the German Jordanian University (GJU) since September 2015. Dr. Alouneh obtained his BSc in electrical and computer engineering from Jordan University of Science and Technology (JUST), Jordan in 2000, and his MSc and PhD from Concordia University, Canada in 2004 and 2008, respectively. His research interests include computer and communication networks, big data security, cloud computing, software security, MPLS security and recovery, wireless networks security, software testing, computer design and architecture. Dr. Alouneh has published several journal and conference articles (18 Journals and 19 conferences), most of them during his service at GJU. He has also contributed to a total of ten national and international projects during his service at GJU. (e.g. Tempus, Erasmus, FP7, DFG, Kuwait University seed grant, GJU seed grants). Dr. Alouneh served as the vice dean of the deanship of graduate studies and scientific research at GJU from March 2014 to March 2015. He also served as the director of the computer center at GJU from July 2009 to January 2012.

Poster #59

A new classification approach for big data security based on networks labeling

Handling big data is becoming a vital and an increasingly emerging research work in computing, and hence has recently attracted the attention of several research groups. What makes big data processing and handling different is the type of data, high velocity, and volume. Therefore, traditional techniques and current processing capabilities may not be suitable and efficient, especially, while processing big data information that requires security and privacy consideration. Accordingly, we propose to process big data in two different tiers. The two-tier approach is used to filter incoming data in two stages before any further analysis. Tier 1 is responsible for filtering incoming data by deciding on whether it is structured or non-structured. Thus, security analysis will be more likely applied on structured data or otherwise based on selection. Tier 2 is responsible for processing and analyzing big data traffic based on volume, velocity, and variety factors. The core idea in the proposed algorithms depends on the use of labels to filter and categorize the processed big data traffic. The network core labels are used to help tier node(s) to decide on the type and category of processed data. Thus, the use of MPLS labels reduces the burden on tier node(s) to do the classification task and therefore this approach improves the performance. On the other hand, if nodes do not support labeling capabilities, then classification with regular network routing protocols will consume more time and extra bandwidth. Simulation results demonstrated that using classification feedback from a labeled core network proved to be key in reducing the data evaluation, overhead, and processing time

Ervin Sejdic

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Dr. Ervin Sejdić received BESc and PhD degrees in electrical engineering from the University of Western Ontario, London, Ontario, Canada in 2002 and 2008, respectively. From 2008 to 2010, he was a postdoctoral fellow at the University of Toronto with a cross-appointment at Bloorview Kids Rehab, Canada's largest children's rehabilitation teaching hospital. From 2010 until 2011, he was a research fellow at Harvard Medical School with a cross-appointment at Beth Israel Deaconess Medical Center. From his earliest exposure to research, he has been eager to contribute to the advancement of scientific knowledge through carefully executed experiments and ground-breaking published work. This has resulted in co-authoring over 130 journal publications. In February 2016, President Obama named Dr. Sejdić as a recipient of the Presidential Early Career Award for Scientists and Engineers. In 2017, Dr. Sejdić was awarded the National Science Foundation CAREER Award. Dr. Sejdić's passion for discovery and innovation drives his constant endeavors to connect advances in engineering to society's most challenging problems. Hence, his research interests include biomedical signal processing, gait analysis, swallowing difficulties, advanced information systems in medicine, rehabilitation engineering, assistive technologies and anticipatory medical devices.

Poster #60

Engineering human functions: Novel data analytics and instrumentation to alter swallowing and gait

A human body comprises of several physiological systems that carry out specific functions necessary for daily living. Traumatic injuries, diseases and aging negatively impact human functions, which can cause a decreased quality of life and many other socio-economical and medical issues. Accurate models of human functions are needed to propose interventions and treatments that can restore deteriorated human functions. Therefore, our research aims to develop novel data analytics and instrumentation approaches that can accurately assess changes in swallowing, and gait functions by focusing on dynamical interactions between musculoskeletal and other physiological systems. In this talk, I will present some of our recent contributions dealing with both engineering and clinical aspects of our work. Lastly, I will also present our future research goals and our strategy to achieve these goals.

Mbarka Selmi

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Dr. Selmi is an assistant professor of civil engineering at the National Engineering School of Gabes (ENIG, University of Gabes) and a researcher at the Civil Engineering Laboratory (L.G.C.-ENIT, University of Tunis EL-Manar)). She obtained her PhD and master's degrees from the National Engineering School of Tunis in 2011 and 2005 respectively. Her research interests include numerical soil modeling, reliability analyses and geotechnical risk assessments related mainly with slopes stability and foundations.

Poster #61

Effect of soil spatial variability on onshore and offshore foundations.

Predicting bearing capacity of shallow foundations is one of the most serious problems in geotechnical engineering. Initially, most works focused on the evaluation of the vertical foundations capacity as this is the predominant loading due to the infrastructure self-weight. More recently with the development of the offshore oil and gas industry, significant attention has been assigned to the capacity of foundations, subjected to VHM combined loading frequently due to environmental factors likely to occur in deep water. In this aim, a deterministic bearing capacity assessment is traditionally derived using a global safety factor based on constant soil properties values chosen by implementing local experience and engineering judgment. However, it is well known in the geotechnical field that soils are highly variable in their properties and rarely homogeneous by nature because of different depositional and post-depositional processes to which they were submitted during their composition histories. These variations, mainly attributed to the inherent spatial soil variability, make the identification of properties incomplete and uncertain. Consequently, the resulting safety factor is not a consistent measure of risk evaluation since foundations with the same safety factor may exhibit different risk levels depending on the variability of the soil properties. As such, a statistical description of these and a probability calculation constitute extremely precious tools to quantify the soil uncertainties and to incorporate them into onshore and offshore foundations designs and analyses. In this context, a probabilistic methodology using the random finite element method (RFEM) will be proposed to assess the uncertainties effect on shallow foundations reponse. Findings highlight the importance of probabilistic analyses, with appropriate statistical soil characterization, as complementary to the conventional deterministic approach to predict the foundations failure.

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Dr. Haïtham Sghaier is an engineer in biotechnology and associate professor of radiation and computational microbiology at the National Center for Nuclear Sciences and Technology (CNSTN) in Tunisia. He was educated at the Technical School (Kebili, Tunisia), INAT (Tunis, Tunisia) and ENIS (Sfax, Tunisia). He obtained a master's degree from Kiryu Faculty of Engineering (Japan) and a PhD following his research done at the Japan Atomic Energy Agency (JAEA, Japan). Being a glossophile, he won the 2002 best prize of Gunma University of the Third Speech Contest for foreign students. In 2007, he joined CNSTN and in 2016 he received the TWAS Young Arab Scientist (YAS) Prize. The basic research of Dr. Sghaier is related to the study of microbial resistomes, (oxidative) stress tolerance, and interactions among prokaryotes/eukaryotes through computational biology and omics tools. Currently, he is involved in various ongoing multi-omics projects and databases about IRRP, extremophiles, biotechnologically-relevant or disease-associated microbes.

Poster #63

Determination of the radiation sterilization dose (RSD) of bio-hazards using omics data

Because of the limitations of standard microbiological methods (associated with radiation sterilization) that do not identify all existing microorganisms, this work aims to formulate guidelines for the determination of the radiation sterilization dose (RSD) of bio-hazard related samples (radiation sterilization) through the calculation of the dose necessary for 90% reduction (D10) in colony forming units (CFUs)) based on the entire microbiota deciphered via metataxonomics and metaproteomics analyses. Consequently, this project will:) Provide guidance for the omics-based microbial taxonomy and enumeration pre- and post-radiation; 2) Provide reliable data about radiation inactivation of bio-contaminants; and 3) Validate treatment of bio-hazards using non-gamma-radiation facilities (as an alternative method) based on a reference method (sterilization via cobalt-60).

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Dr. Dinesh Shetty is currently a research scientist at New York University Abu Dhabi where he specializes in the design and development of porous materials and macrocyclic chemistry for various applications including water purification. He holds MSc and PhD degrees in chemistry from Mangalore University, India and Seoul National University (SNU), South Korea, respectively. From 2011 to 2013, he was a postdoctoral fellow at Winship Cancer Institute, Emory University, USA and later moved back to South Korea in the year 2013 where he was a research fellow in the group of Professor Kimoon Kim at the Center for Self-assembly and Complexity, Institute for Basic Science, POSTECH. He is a trained organic chemist with working experience in multidisciplinary research areas including material science and bio-medical science since last 12 years. He is the author of 28 peer reviewed journal papers, 20 conference papers, and 4 patents with h-index of 14. He received the Young Investigator Award from both the Korean Society of Nuclear Medicine and Korean Cancer Research Foundation. He has delivered research talks in multiple countries and is currently an active member of Royal Society of Chemistry and American Chemical Society. In addition, he has been serving in the World Molecular Imaging Congress (WMIC) abstract review committee member for the last three years.

Poster #56

Multifunctional porous polycalix[n]arenes for efficient water purification

Several modern environmental technologies are benefited from novel multi-functional materials. In this regard, porous organic polymers (POPs) are a promising class because of their ultrahigh hydrothermal stabilities, light weight, and high yielding synthetic polymer chemistry. Calix[n]arenes (n = 4, 6, 8) have long been recognized as versatile supramolecular scaffolds, however, we are the first to report a calixa[n]arene based porous polymers. Building on these findings, we synthesized a library of calixarene based porous materials (CalPn and CalPn-Li; n = 2-4) with BET surface areas ranged from 500 to 1000 m2 g-1. These materails were tested for multiple applications including: 1) oil spill recovery; 2) toxic dyes and micropollutants removal, 3) iodine vapour enrichment, and 4) paraquat and mercury removal. Results obtained by these materials are significantly superior than those from most adsorbent materials reported previously. For example, we achieved 312% (w/w) of iodine vapor adsorption, which is one of the highest measured for any porous material. Also, these polymers exhibit organic micropollutant uptake rates (kobs) and adsorption capacities (qmax) that are among the highest reported (the kobs for bisphenol A is 2.12 mg g_{-1} min_{-1}, which is 16 to 240 times higher than kobs for activated carbons; the qmax for BPA is 403 mg g-1). Moreover, these polymers can be easily regenerated using mild washing procedures and reused several times without loss of absorption efficiency. The high efficiency and ease of implementation of our polymers demonstrate the advantages of incorporating the calixarene moiety within a functional material and bode well for the development of calixarene-based materials for environmental applications.

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Don Siegel is an associate professor and associate chair for graduate education in the Departments of Mechanical Engineering, Materials Science & Engineering, and Applied Physics at the University of Michigan. His research targets the development of energy storage materials and lightweight alloys, primarily for applications in the transportation sector. Prior to joining UM, he was a technical expert at Ford Research and Advanced Engineering. Don has co-authored more than 80 publications, delivered approximately 90 invited lectures, and has been awarded several patents related to energy storage. He is a recipient of the NSF Career Award, the SAE Teetor Educational Award, and an NAE Gilbreth Lectureship. Prof. Siegel has been active in providing input to the U.S. Department of Energy on issues related to energy storage, having served as co-chair for the FreedomCAR Hydrogen Storage Technical Team, a reviewer for the Hydrogen and Vehicle Technologies Program, and as a member of the Joint Center for Energy Storage Research (JCESR) Directorate. A physicist by training, Prof. Siegel received a PhD from the University of Illinois at Urbana-Champaign. His postdoctoral research was performed at Sandia National Laboratories and at the U.S. Naval Research Lab. During the 2015-2016 academic year he was a VELUX Visiting Professor in the Department of Energy Conversion and Storage at the Technical University of Denmark.

Poster #1

Big data in materials science: Application to energy storage materials

The impact from ‹big data› in materials science and chemistry has been slow to emerge. This is primarily because few large datasets exist in these fields, and public distribution of the datasets that do exist is uncommon. This poster describes an effort to circumvent these limitations by computationally generating property-performance databases for hundreds of thousands of compounds. High-throughput screening is been used to predict the energy storage densities of materials useful for the storage of chemical, thermal, and electrical energy. For smaller datasets, these screening calculations can be sufficient to identify promising materials. However, as the dataset grows, computational limitations prohibit evaluations on all dataset members. In this case we demonstrate that machine learning can be used both to enable rapid and reliable predictions on large datasets, and to extract design rules from the data.

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Dr. Sparks joined the Materials Science and Engineering Department at the University of Utah as an assistant professor in 2013. He is originally from Utah and an alumni of the department he now teaches in. Before graduate school he worked at Ceramatec Inc. He did his MSc in materials at UCSB and his PhD in applied physics at Harvard University in David Clarke's laboratory and then did a postdoc with Ram Seshadri in the Materials Research Laboratory at UCSB. He is currently the director of the Materials Characterization Lab at the University of Utah and teaches classes on ceramics, materials science, characterization, and technology commercialization. His current research centers on the discovery, synthesis, characterization, and properties of new materials for energy applications. He is a pioneer in the emerging field of materials informatics whereby big data, data mining, and machine learning are leveraged to solve challenges in materials science.

Poster #64

Accelerating the discovery of new superhard materials via materials informatics

Superhard materials serve critical roles in society by enabling manufacturing processes such as cutting, grinding, and turning. They also allow for drilling necessary to access subterranean energy reservoirs. In the pursuit of materials with exceptional mechanical properties, a machine-learning model is developed to direct the synthetic efforts towards compounds with high hardness by predicting the elastic moduli as a proxy. This approach screens 118,287 compounds compiled in crystal structure databases for the materials with the highest bulk and shear moduli determined by support vector machine regression. Following these models, a ternary rhenium tungsten carbide and a quaternary molybdenum tungsten borocarbide are selected and synthesized at ambient pressure. High pressure diamond anvil cell measurements corroborate the machine-learning prediction of the bulk modulus with less than 10% error, as well as confirm the ultraincompressible nature of both compounds. Subsequent Vickers microhardness measurements reveal that each compound also has an extremely high hardness exceeding the superhard threshold of 40 GPa at low loads (0.49 N). These results show the effectiveness of materials development through state-of-the-art machine-learning techniques by identifying functional inorganic materials.

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Rafik Taleb, DEng, is an associate professor of civil engineering at the University of Blida 1, Algeria, and is head of the structural dynamics research team at Laboratory of Civil Engineering and Geomaterials, University of Blida 1. He majored in civil engineering at University of Blida, Algeria (2000), and earned an MSc in civil engineering from the University of Clermont-Ferrand II, France (2005). He earned a master's in earthquake disaster management from GRIPS, Japan (2009) and a DEng in environmental science and technology from Tokyo Institute of Technology as a MEXT Scholarship student. Prior to joining the University of Blida 1, he served as research assistant at the National Earthquake Engineering Center, Algeria. Dr. Taleb has written numerous publications and research reports related to structure earthquake-resistant design, experimental evaluation of the seismic performance of reinforced concrete members, structural dynamics and numerical simulation, and he is participating in the ongoing revision of the Algerian seismic design code for buildings.

Poster #65

Seismic peformance of structural reinforced concrete walls

Observed damages in reinforced concrete wall buildings following recent earthquakes raised concerns about the seismic performance of rectangular RC walls. An experimental study under cyclic reversed in-plane loading was conducted on seven 40%-scale reinforced concrete (RC) structural walls designed to fail in flexure. Considered walls included two walls with barbell shaped sections and five walls with rectangular cross-sections and having different transverse reinforcement ratio at their confined end regions. Primary test variables were cross sectional shape (rectangular and barbell shapes), transverse reinforcement ratio in confined end regions, shear span to wall length ratio, and axial load ratio. The main objective of this study was to investigate the effects of end region detailing of reinforced concrete (RC) structural walls on their seismic performance.

Test results showed that concrete crushing spread widely over the plastic hinge region with buckling of longitudinal reinforcement at the final loading stage for rectangular walls, while for walls with barbell shape, the crushing of concrete was essentially limited within boundary columns but led to a more brittle failure than that of rectangular walls. Walls with a barbell-shape showed the efficiency of boundary columns in increasing deformation capacity and reducing the damage level in the wall panel. It was also shown that the damage region was limited in height and tends to spread more horizontally toward the wall center. Test results also made clear that end regions should be confined when a structural wall, especially a rectangular wall, is expected to sustain large deformation.

A simplified fiber section analysis based on the plastic hinge length and moment-curvature analysis is proposed to estimate the total lateral load-displacement hysteresis. The proposed fiber model well simulated the hysteretic behavior of the tested wall specimens.

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William Tarpeh is an assistant professor of chemical engineering at Stanford University. His research focuses on extracting valuable products from wastewater by investigating electrochemical treatment processes, kinetics of contaminant transformation, and systems-level environmental impacts. Recent projects include producing nitrogen fertilizers from urine, screening pharmaceutical transformations during water treatment, and electrocatalytic hydrogenation. Before starting his faculty position, William conducted postdoctoral training at University of Michigan, earned his MSc and PhD in environmental engineering at UC Berkeley, and completed a BSc in chemical engineering at Stanford.

Poster #66

Electrochemical nitrogen recovery from wastewater

Extracting nitrogen from wastewater can reduce costs and energy required for wastewater treatment and fertilizer production. In this study we evaluated electrochemical stripping, a novel approach for electrocatalytic nitrogen recovery that improves upon conventional ammonia stripping in two ways: 1) pH increase without base addition and 2) internal NH3 stripping without a tower. We investigated ammonia recovery in a three-chamber design comprised of anodic NH4+ migration, cathodic conversion to NH3, and reconversion to NH4+ in a sulfuric acid trap, producing liquid ammonium sulfate concentrate. To identify urine characteristics that influenced nitrogen recovery, efficiencies were determined for ammonium sulfate (99%), synthetic urine (80%), and real urine (94%). Mechanisms contributing to low recovery in synthetic urine were explored, including electrochemical chloride oxidation and chloramination. Cyclic voltammetry was used to confirm the production of HOCl from Cl-.

Based on continuous-flow nitrogen fluxes, transport from the cathode to the trap chamber was identified as the rate-limiting step of electrochemical stripping. Synthetic urine solutions were used to determine the effects of urine composition and operating parameters on nitrogen flux, recovery efficiencies, and competing reactions. Trace organics and elements were not detected at appreciable levels in the ammonium sulfate fertilizer product. Nitrogen was selectively separated from other urine constituents, including sodium, potassium, inorganic anions, trace organic compounds, and metals. Based on full-cell potentials, we calculated energy requirements per kg of nitrogen recovered and compared electrochemical stripping to existing nitrogen removal technologies like nitrification-denitrification, anammox, and conventional ammonia stripping. Results from this study demonstrate proof-of-concept for electrocatalytic nitrogen recovery to simultaneously improve water quality and produce fertilizer.

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Dr. Tompkins is an engineer, scientist, and planner with extensive experience developing and implementing water resources management and aquatic ecosystem restoration projects. He has over twenty years of experience focused on flood management, river restoration, applied fluvial geomorphology, and aquatic ecology. Dr. Tompkins serves on interdisciplinary technical advisory committees for the San Joaquin River Restoration Program and the Cache Creek Improvement Program, where he advises on large-scale water supply, flood, and ecosystem management issues. Over the past decade Dr. Tompkins has planned, designed, and implemented dozens of flood management and ecosystem restoration projects on the Sacramento and San Joaquin Rivers and many of their tributaries, the Bay Delta, the Klamath River, and many other river systems across the country. Dr. Tompkins is also a leader in the application of open data standards and open source analytics and cloud computing to the adaptive management of water resources to accelerate the pace of analysis and improve the quality of decisions in water resources management.

Poster #5

Open water data and AI to optimize water resources management and aquatic ecosystem restoration

The great drought of 2011 to 2017 stressed California›s water supply system to the breaking point. The wettest winter in recorded history in 2017 relieved some of the pressure on the faltering water supply, but overwhelmed flood control infrastructure in many parts of the state. Through both drought and flood, aquatic ecosystems in California›s Sacramento - San Joaquin Delta and Central Valley continued to decline as water management focused on extreme deficit and excess. This decline has driven some salmon populations in the Central Valley close to extinction. However, both the drought and flood conditions made it clear that multi-benefit management, especially management focused on wiser use of floodplains, will be essential to the stability and resilience of California›s water supply, flood management, and aquatic ecosystems in the future.

Unfortunately, limited data availability on Central Valley floodplains has presented a major barrier to wiser use of floodplains. To address this data gap, we initiated a project that builds upon recent hydraulic modeling studies integrated with high resolution daily satellite imagery. Using Artificial Intelligence (AI) (piloted with Google's Earth Engine platform), we have developed an approach to quantify the dynamics of floodplain inundation in the Central Valley of California at a spatial scale not previously possible. This approach allows us to continuously update relationships between river flows, inundation, and floodplain habitat creation for juvenile salmon as future high flows and channel evolution change Central Valley rivers in California. Using outputs from this approach, we have begun to identify and prioritize floodplain rearing habitat creation projects under alternative future flow regimes that will be critical to a wide range of water resources planning processes that California is currently undertaking to improve the stability and resilience of the water resources system that serves the entire state.

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Dr. Fatma Trabelsi is an assistant professor in hydrogeology, GIS, and remote sensing. She earned a doctorate in geology (specialty: hydrogeology) at the Faculty of Sciences of Tunis in 2013. She works at the Higher School of Engineers of Medjez El Bab (University of Jendouba). She is a lecturer and a supervisor for engineering diplomas in hydraulics and research master's degrees in climate change and water management. Thus, her teaching experience is in accordance with her research interests focused on groundwater sciences, in addition to environmental and sustainability challenges. Throughout her career, she has 48 publications between articles, proceedings, and oral communications. Between 2013 and 2018, she was the principal investigator of four projects funded by different grants, including the European Union ERASMUS+ program, the bilateral cooperation between Korea & Tunisia, the European Union ENPI CBC MED program, and the bilateral cooperation between India & Tunisia.

Poster #52

Geomatics for delineation of groundwater potential zones in the Medjerda watershed, Tunisia

In Tunisia, water resources are already limited in space and time. Their sustainable management is a national priority for ensuring water security and development of the country. The Medjerda river basin is the largest watershed in Tunisia, where local surface water resources are relatively well managed, groundwater resources are more hidden and difficult to conceptualize; additionally there is a gap of groundwater data. Mapping of groundwater resources is one of the main tools for the controlled development of groundwater resources. Integrated remote sensing (RS) and geographic information system (GIS) are widely used in groundwater mapping. Locating potential groundwater targets is more convenient and cost effective than invasive methods with the advent of RS data. The nature of RS-based groundwater exploration is to delineate all possible features connected with the localization of groundwater. The main goal of this study is to investigate the analytical hierarchy process (AHP) and the probabilistic-based frequency ratio (FR) models for groundwater potential mapping (GPM) using GIS and RS at Medjerda basin. This study includes the analysis of the spatial relationships between transmissivity (T) and various conditioning factors such as elevation, slope, curvature, river, lineament, geology, soil, rainfall, and land use. 18 groundwater-related factors were extracted from topographic and geological data, satellite imagery. Groundwater data of T were randomly split into a training dataset, 70 % for training the model and the remaining 30 % was used for validation purpose. Subsequently, GPM were produced using AHP and FR models classified as very high, high, moderate, low, and very low zones. Finally, the receiver operating characteristic (ROC) curves for all the groundwater potential models were constructed and the areas under the curves (AUC) were computed. These results of GPM can be helpful for future planning in groundwater resource management and land use planning.

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George Wells is an assistant professor in the Department of Civil and Environmental Engineering at Northwestern University, where he directs the Environmental Biotechnology and Microbial Ecology Laboratory. His primary research interests are microbial nitrogen and phosphorus cycling and shortcut biological nutrient removal processes, resource and energy recovery from wastewater, microbial ecology of engineered and impacted natural systems, sustainable biological wastewater treatment, and microbial greenhouse gas production. George received his BSc in chemical engineering and BA in environmental engineering from Rice University in 2004. After a short period working at BP Chemicals in Naperville, Illinois, George joined the Department of Civil and Environmental Engineering at Stanford University, where he completed his MSc (2006) and PhD (2011) under Dr. Craig Criddle and Dr. Chris Francis. Prior to joining Northwestern University in the fall of 2013, George spent nearly 2.5 years as a postdoctoral scholar under Dr. Eberhard Morgenroth at Eawag- the Swiss Federal Institute of Aquatic Science and Technology (near Zürich, Switzerland).

Poster #68

Microbial community engineering for clean water, renewable energy, and resource recovery

At the Wells Environmental Biotechnology and Microbial Ecology Lab, we ask how complex microbial communities assemble, fluctuate over time and space, and function, and then seek to put these microbial communities to work to clean water, prevent nutrient pollution, and recover useful resources from wastewater and other urban waste streams. Our research is inherently interdisciplinary, and requires integration of cutting edge microbiome and microscopy tools, environmental bioprocess modeling and development, and classical microbiology techniques. Water systems, microbiome science, and urban sustainability are central themes of our research efforts. In this poster, I will detail new results from our efforts to develop novel shortcut nitrogen (N) and phosphorus (P) removal microbial bioprocesses to generate clean water for reuse, prevent nutrient pollution, and recover resources from wastewater. These processes leverage new understanding of metabolic versatility in the microbial world, namely by anammox bacteria and by denitrifying polyphosphate accumulating organisms (DPAOs). Our results show that hybrid (biofilm and suspended growth) anammox bioprocesses can effectively treat mainstream municipal wastewater and reduce energy requirements for N removal by 60%. Allied efforts to integrate shortcut N removal with DPAOs in a new process termed CANDO+P provides proof-of-feasibility for sustainable N removal, P recovery as a fertilizer, and energy generation via microbial nitrous oxide production and capture. In parallel to reactor testing to constrain performance in anammox and CANDO+P processes, we've characterized structure-function relationships and metabolic networks in the underlying reactor microbiomes with genome-resolved shotgun metagenomic and metatranscriptomic techniques. Together, this work demonstrates the utility of coupling novel bioprocess development for water/wastewater treatment to fundamental microbial

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Dr. Yassin graduated with a bachelor's degree in pharmacy from Cairo University in 1996 where he worked as a teaching and research assistant at the Department of Microbiology and Immunology. He started his PhD in pharmaceutical biotechnology in 2000 at the University of Illinois at Chicago, USA. In his PhD project, Dr. Yassin mapped novel antibiotic sites in the bacterial ribosome. He completed a postdoc at Wadsworth Center, New York State Department of Health between 2008 and 2011, where he worked on solving the cryo- electron microscopy structural complexes of several bacterial and mitochondrial ribosomes. Since 2011, he has been at Cairo University where he is currently a full professor. Dr. Yassin participated in several projects dealing with bacterial and viral epidemiology and virulence, pharmaceutical microbiology and biotechnology. He also teaches a selection of undergraduate and graduate courses. Currently, he is working on analyzing the microbiome composition of different fresh water and soil sediment samples from different locations throughout the Egyptian environment. The aim is to characterize the microbial diversity of these habitats and analyze the factors affecting their composition by studying their abundance through 16S rRNA gene analysis. His plan is to extend this work to the metagenomics and metatransciptomics level to gain a wider comprehensive view of the exact community structure and genes expressed at the sites under study.

Poster #43

Spatiotemporal analysis of the Nile river microbial diversity along the Cairo metropolis

The Nile, one of the longest rivers in the world, is a north-flowing river in northeast Africa. Along its flow through eleven countries, it is expected to show both spatial and temporal variation in its water quality with regards to location and seasons. Little is known about the associated microbial composition of this influential river. In this work, we present the first microbiome analysis of Nile river water in two seasons, with summer representing the wet season and winter representing the dry seasons around the Cairo-metropolis, the capital of Egypt and one of the largest and busiest metropolis areas around the world. Water samples from the surface of the river were collected from selected locations along the path of river flow around Cairo. Locations were chosen to represent possible variations in the quality of water as related to the existence of industrial complexes around the river banks as well as residential areas. The microbial composition was analyzed by next generation sequencing of the 16S rRNA gene to identify the community structure. Comparisons were made with a variety of other microbiome communities from different ecosystems representing water, human, and animal origins. Our results reveal a striking stability in the community structure along the examined sites suggesting that surface water communities in large rivers exhibit limited variation. Similarities with other fresh water microbial community structures were noticed. Our results shed the first glimpse of light on the core microbial composition of one of the most influential rivers around one of the most ancient metropolis areas, worldwide.

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Dr. Ngai Yin Yip received his PhD, MSc, and MPh in hcemical and environmental engineering from Yale University, and BEng in civil and environmental engineering (minor in business administration) from Nanyang Technological University, Singapore. He joined Columbia University in 2015 as an assistant professor in the Department of Earth and Environmental Engineering. Dr. Yip's research interest is in advancing technologies and innovations to address challenges at the nexus of water, energy, and the environment. Currently, his research group is focused on desalination of hypersaline brines, including (i) novel membrane-based technologies to achieve higher recovery rates in seawater desalination, (ii) developing membrane-less and non-evaporative techniques to treat technically-challenging produced water from oil and gas operations, and (iii) thermodynamic and energy analysis of desalination processes. Other ongoing research areas include (iv) advancing novel materials for salt-rejecting membranes and (v) sustainable harvesting of nutrients form anthropogenic wastestreams. His dissertation work on novel membrane technologies for the sustainable production of energy and water earned the CH2M Hill/AEESP Outstanding Doctoral Dissertation Award and the Henry Prentiss Becton Graduate Prize in 2015. Dr. Yip authored numerous peer-reviewed publications on desalination and water purification, and has won the Environmental Science & Technology Best Papers (second runner-up in 2013).

Poster #9

Desalination of high-salinity brines: Novel energy-efficient technologies

The current practice of using thermally-driven methods to treat hypersaline brines is highly energy-intensive and costly. While conventional reverse osmosis (RO) is the most efficient desalination technique, it is confined to purifying seawater and lower salinity sources. Hydraulic pressure restrictions render RO unsuitable for high-salinity streams. Here, we present two novel technologies for hypersaline desalination: cascading osmotically mediated reverse osmosis (COMRO) and temperature swing solvent extraction (TSSE). The first technology, COMRO, utilizes the novel design of bilateral countercurrent reverse osmosis stages to lessening the osmotic pressure difference across the membrane, thereby depressing the hydraulic pressure needed. Our study indicates COMRO can treat hypersaline brines or achieve high recovery desalination with moderate hydraulic pressures well within practical limits. Crucially, the specific energy requirement of COMRO is 2.1-3.8 kWh per cubic meter of product water, approximately an order of magnitude lower than the prevailing thermal methods of, for example, mechanical vapor compression and thermal crystallizer. The second technology, TSSE, is membrane-less and not based on evaporative phase-change. The technology utilizes a low-polarity solvent that is immiscible with aqueous solutions to extract water from hypersaline brines. Because water solubility of the solvent is highly temperature-sensitive, a mild temperature swing supplied by a low-grade heat source, such as industrial waste heat, shallow-well geothermal, and low-concentration solar collectors, can drive efficient separation to yield product water and a brine concentrate. Our investigation shows that TSSE can desalinate ultrahigh salinities of up to 235,000 ppm TDS (4.0 mol/L NaCl, approximately 7 times seawater salinity), with salt removal rates as high as 97.3%, using only a moderate temperature swing of 17 to 68 degrees C.

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Dr. Adel Zghibi is assistant-professor of hydrogeology and water engineering at the Faculty of Sciences of Tunisia, Department of Geology. In 2004, he graduated with a degree in rural and water engineering from the National Agronomic Institute of Tunisia. In 2007, he obtained a master's degree in hydraulic engineering and then received his PhD in rural engineering, water and forest in 2013. He is a researcher in water resources management at the Faculty of Sciences of Tunisia. His research is mainly focused on modelling flow and mass transport processes in heterogeneous porous and fractured media. He is also interested in the complex interactions that occur on the terrestrial landscape involving water and nutrient cycles, and specifically how hydrological processes interact with and control these cycles. The study of integrated hydro-geochemistry cycles is challenging due to the numerous processes and linkages that govern the dynamics of individual element cycles. He is the author of several scientific papers refereed in international journals and articles in journals, book chapters, specialised monographs and proceedings about hydrology and water engineering. He is a reviewer for several international journals.

Poster #16

Approaches to achieve sustainable groundwater management in the southern shore of the Mediterranean

This Tunisian case study is particularly exposed to water stress. This situation, which originates from natural conditions of water scarcity, is aggravated by increasing levels of consumption and climate change, making the region a "global hotspot of unsustainable water use." The risk of groundwater depletion is real in some countries with rates of abstraction are much higher than those of replenishment. Also, aquifers are less and less isolated from intrusions of various elements that alter the quality of the water stocked, thus reducing its suitability for direct uses. Since agricultural water demand is the main driver of groundwater depletion, it is becoming clear that action needs to be taken at different levels in terms of improved monitoring, regulation (of water abstraction), crop shifting (towards less thirsty crops), and water pricing. The challenge looks very different for Tunisia where the sector is already highly mechanized. Our novel technical approach will empower the farming community in a severely water stressed coastal region of Tunisia by characterizing hydrogeological factors that constrain long-term business-as-usual agricultural water management practices, provide technical tools and data collection capabilities to assess groundwater depletion, and prescribe corrective action. Furthermore, quantitative understanding of the various factors affecting groundwater flow and solute transport processes are essential for sustainable groundwater resource development and operation of coastal well fields. Numerical simulations have become a practical tool for informed coastal groundwater management by improving understanding of the spatial extent and rate of seawater intrusion. Different analysis methods have been developed to address this weakness, including scenario-based simulation of the hydrodynamic equilibrium between freshwater/seawater.

Notes

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